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The First Casting Made in America.

Our readers should not hastily conclude, from an inspection of the accompanying engravings, that we have concluded to follow the example of some of our esteemed contemporaries and publish accounts of the latest improved kitchen utensils and general hardware along with machinery matters. We publish this engraving because it represents, quite accurately, what there is every reason to believe is the first iron casting made in America, and, as such, we know it will be of great interest.

On October 21, Mr. C. J. H. Woodbury made the presentation address by which this casting was given to the city of Lynn, Mass., the casting having been previously purchased by him from the family in whose possession it had been since it was first made. After its purchase, a number of citizens of Lynn insisted upon being allowed to bear part of the expense of presenting it to the city, and subscribed for that purpose, but John E. Hudson, Esq., of Boston, who was born in Lynn, and is a direct descendant of Thomas Hudson, who owned the ground upon which the Saugus Iron Works were built, claimed the privilege of presenting the casting to his native city—a privilege which was granted him, the subscribers then contenting themselves with supplying the tablet and case in which the kettle will hereafter be preserved. The kettle is quite a small one, weighing two pounds four ounces without the cover, and holding not quite a quart. From Mr. Woodbury's address we take the following interesting passages.

As the kettle is an example of the state of the art of iron founding in 1642, so the tablet, forming the rear of the case, is also typical of the skill of American foundrymen in 1892. It is as it came from the mold at the foundry of the Magee Furnace Company, at Chelsea, untouched by tools, and has been treated by the Bower-Barff process, covering it with the magnetic oxide of iron, to prevent corrosion.

There are some original features in the design of this tablet, particularly in the groundwork of the face, of which the pattern was woven bamboo, and the back is in like manner an impression of plaited straw, instead of the tooled surfaces which are used for similar tablets.

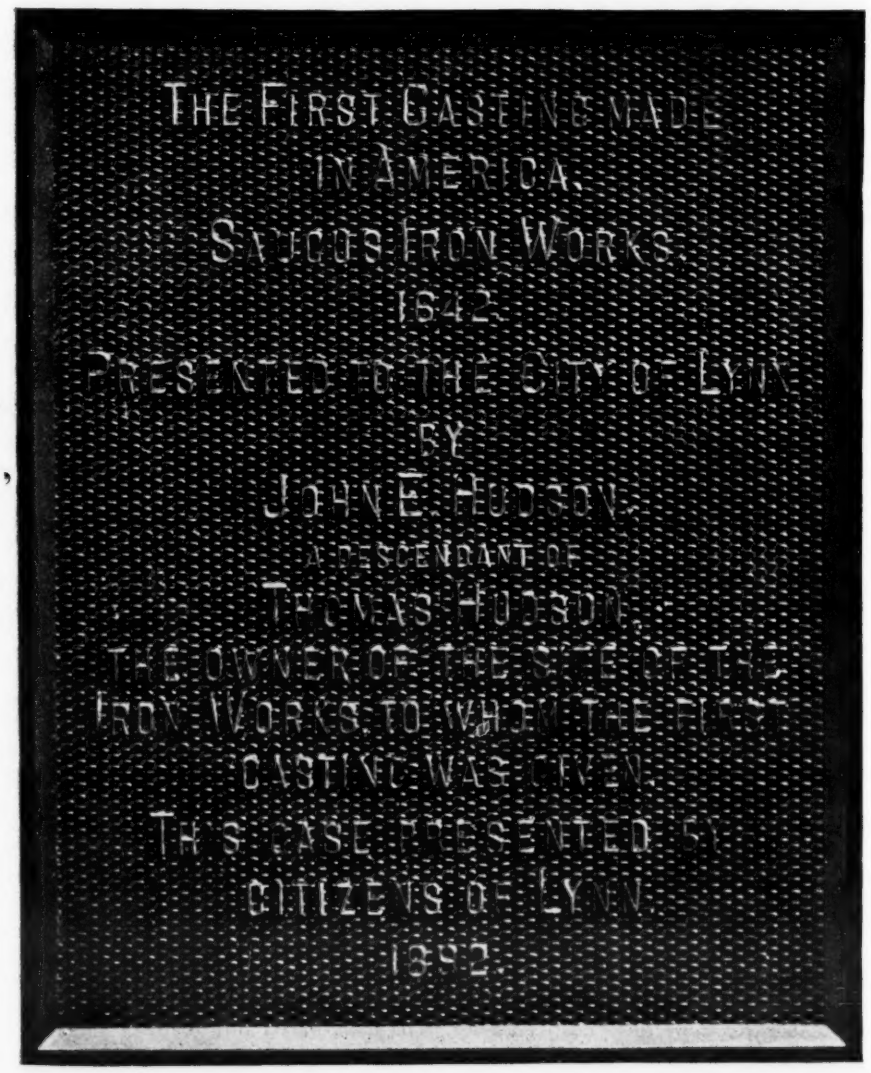
The tablet bears the inscription as shown above.

It may be very naturally asked, What is the evidence warranting the presumption that this kettle is, as claimed, the first casting made at the Saugus Iron Works? It is true that this article lacks the stamp and attested record of many witnesses, but, like Plymouth Rock, and many other important relics of American history, it depends in part upon tradition in a generation devoid of sentiment or personal interest, which might introduce possible elements of error. Tradition has preserved for the world much of its history, essential principles of law, and even vital points in both Jewish and Christian religion.

The design of the kettle is that of a type used in the earliest colonial days, but in its physical characteristics it bears evidence of being made of iron cast directly from the ore as reduced in a blast furnace, and not from pig-iron re-melted in a reverberatory or a cupola furnace; and there is no evidence or reason to believe that there was either of these furnaces at the Saugus Iron Works.

Thomas Hudson owned sixty acres of land on the westerly bank of the Saugus River, at the present sites of Scott's and of Pranker's mills, and he sold this land to the Company of Undertakers for the Iron Works. He claimed in consideration the first article made at the works, and although not given to idealisms, this kettle was kept by him and his descendants in the male line for over a century, when it passed in the fourth generation to Mary (Hudson) Lewis, who gave it to her daughter, Mary Lewis, and she in turn gave it to her nephews, Arthur and Llewellyn Lewis, from whom the purchase was made. These two brothers well remember the story of the kettle as told by their grandmother, who prized this kettle as an heirloom, whose history had, in a like manner, been related to her by her grandparents. The first published record of this kettle is contained under date of 1642, in the History of Lynn, by Alonzo Lewis, 1844, page 122. The same is included in Lewis' and Newhall's History of Lynn (1890), page 208, and is referred to in every history treating of the Saugus Iron Works. The Standard History of Essex County, C. F. Jewett (1878), of which the chapters upon Lynn were prepared by the late Cyrus Mason Tracy, contains (page 246) a description of this kettle; and I have in my possession a manuscript written by Mr. Tracy in 1881, in which that able antiquary eloquently referred to it as "the humble prototype of the immense iron industry that now extends over our land." Further references on this subject may be made to Vol. I, page 408, of the History of Essex County, Massachussetts (J. W. Lewis, Philadelphia, 1888), in which the chapters on Saugus were written by Wilbur F. Newhall, Esq.

The Saugus Iron Works were such an important factor in the inception and early development of American industries that their early history merits due consideration. This was not the first attempt at iron smelting, but the first success. The expectancy for mineral wealth was universal among the early explorers of America. Every royal charter, patent, grant or commission contained exact



THE FIRST CASTING MADE IN AMERICA.

provisions for the division of precious and base metals, in which the privy purse was to share largely. The avaricious Spaniards expected gold, and abased Columbus because he had not found it in fabulous plenty. The later Spanish explorers pillaged enough gold in Mexico and Peru to trample out the Aztec civilization, and in turn ruin themselves. The outline of the western Atlantic littoral had not been fully established before Spanish romancers pictured the unknown lands with strange peoples, who submissively yielded to the conquerors, and bestowed upon them a plethora of precious metals. The thrifty English were not blind to the attraction of mineral wealth, and sought the less alluring but more valuable iron, although that metal was unknown to the Indians, save in a few instances recently discovered by Prof. F. W. Putnam, where the mound builders fashioned meteoric iron into ornaments or implements. The earliest reference to iron ore in America is contained in the History of the Second Expedition to Virginia, by Thomas Harriot, in 1586, wherein he says in reference to Roanoke Island: "Wee founde neere the water side the ground to be rockie which by the trial of a mineral man was founde to hold iron richly. It is found in manie places of the country else." The hostility of the natives was so intense that the colonists soon returned to England without developing the mines. The Jamestown Colony mined and sent iron ore to England as early as 1608. (W. F Durfee, American Industries Since Columbus, page 146.) In 1622, they built iron works at Falling Creek, a tributary of the James River, about seventy-six miles from Jamestown, for the purpose of reducing bog-iron ore. The works had approached completion, when the Indians attacked the settlement, killing 350 persons and burning the buildings March 22, 1622. Thus the enterprise for which skilled men had been especially sent to the Jamestown Colony from England was abandoned. (History of the Iron Manufacture in all Ages, page 104, James M. Swank, Philadelphia, 1892.) The Massachusetts Bay Company, at a meeting in London, March 2, 1628, considered the advisability of sending Malbon to New England to prospect for iron ore, and he was at Salem in 1629, but it is not known that he ever reported any discoveries.

The bog-iron deposits in the upper Saugus meadows were discovered by Thomas Dexter, one of the colonists, and he informed his fellow-townsman, Captain Robert Bridges, who went to London and formed the Company of the Undertakers for the iron works, which was started under the management of these two men, with Joseph Jenks, one of the best workmen of the day, as master mechanic. Captain Robert Bridges was one of the leading men of the settlement, having been intrusted with diplomatic offices on the part of the colony of Massachusetts Bay, and of whom it was said by Nathan M. Hawkes, "No man who lacked suavity and winning social manners could have persuaded calculating London merchants to have ventured their dearly loved funds in an iron works experiment across the Atlantic in a savage and unknown land." (Magazine of American History, Vol. XXV., page 150.) The site of the iron works was well selected, being situated at the head of navigation, by the ford in the highway from Boston to Salem, at a water-power, and near to the bog-iron ore deposits, whose exact location is unknown, save that they were in Adam Hawkes' meadows. The whole iron works tract probably covered three thousand acres. The General Court granted them at various times immunity from import or export duties, and from taxation, and other privileges. I believe that the act of October 14, 1645, is the earliest instance of legislation upon the principles of protection to manufacturers, which has been such an important feature in the development of American industries. The act is a long document, but the following extracts are of especial interest.

"5. . . They shall have free liberty to transport the same [their iron] by shipping to other parts or places of the world, and to make sale thereof. . . . Provided they sell it not to any person or State in actual hostility with us.

"7. It is also granted that the undertakers and adventurers, together with their agents, servants and assigns, shall be and are hereby free from taxes, assessments, contributions and other public charges whatsoever, for so much of their stock and goods as may be employed in and about the said iron works, for and during the period of twenty-one years yet to come from the date of their presents."

There is not any detailed description of the works and the exact methods employed, but there is much light thrown upon these matters in the voluminous records of continual legislation and litigation, which took place during the forty-six years that the works were in operation. The works contained a blast furnace, in which bog iron ore was reduced by means of charcoal, using, as a flux, lime which in the earliest days of the works was obtained from the oyster shells, which then abounded on the coast of Massachusetts Bay. Cannon were also melted at this foundry, far in advance of the time when swords were to be beaten into plowshares, or spears into pruning-hooks. The iron from the blast furnace was run into straight trenches in the sand, and thereby cast into long triangular bars called "sowe iron," which were converted into wrought-iron and steel. Castings were made directly from the metal flowing from the blast furnace into a pool, whence it was dipped by crucibles and poured into the molds. The cupola furnace was not invented until 1790. The manufacture of wrought-iron and steel must have been entered upon contemporaneously with that of cast-iron, as John Endicott, of Salem, the first Governor of Massachusetts Bay, wrote to Governor John Winthrop, at Boston, December 1, 1642: "I wish to hear much of your son's iron and steel"; the son being John Winthrop, Jr., who was interested in the Saugus Iron Works.

The wrought-iron and steel were made in a blomary, which may be described as a charcoal fire four feet thick in a blacksmith's forge. The end of a bar of sow iron was plunged into the fire, and in time a pasty mass of wrought-iron would settle to the bottom. Other portions of the bar would be converted into steel when the process stopped at the intermediary stage between cast and wrought-iron. This process of steel making is still used throughout the oriental nations, and also in the mountainous region south of the Ohio River.

The iron works also included a machine shop, in which the first fire engines made in America were built for the town of Boston, in accordance with a vote of the town meeting, March 1, 1654, that "The select [men] have power and liberty to agree with Joseph Jynks for Ingins to convey water in case of fire, if they see cause so to do." (Brayley, History Boston Fire Department, 1889, page 7.)

Although the iron works were in operation very soon after building was commenced, yet additions were made during a number of years. In 1645, an order of the General Court shows that the works had "some tons of sowe iron cast and some others in readiness for the forge," and letters of Governor Winthrop in August and September, 1648, state that the furnace produced seven to eight tons per week. The principal product was bar-iron "as good as the Spanish," costing twenty pounds per ton, also axes and agricultural implements.

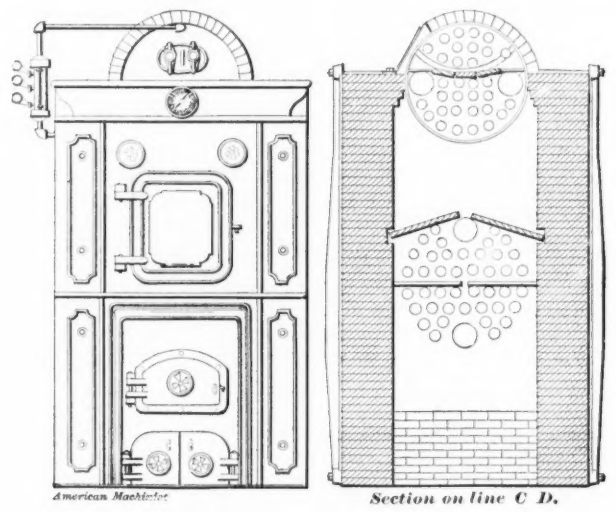
When Governor John Endicott began the Oak Tree and Pine Tree coinage in 1652, the dies were made by Joseph Jenks at the Saugus Iron Works. (Early Coins of America, S. S. Crosby, Boston, 1875, p. 79.) It is stated by Judge James R. Newhall that the designs were made by Elizabeth, the wife of Joseph Jenks, the master mechanic. (Lin, 1880, p. 78.) This coinage, bearing the stamp "Massachvsetts State" without any reference to the throne, was probably the first fundamental act of independence to the mother country. The colonists were driven to such a course by the lack of money, as exchanges were for the most part carried on in barter, with bullets and wampum serving for small coin. Joseph Jenks also invented a saw-mill, which received a patent for fourteen years from the General Court on June 10, 1646, being the first patent granted in America, and also a water engine for mills, which was undoubtedly a form of water-wheel and not the hydraulic engine which that term would now signify.

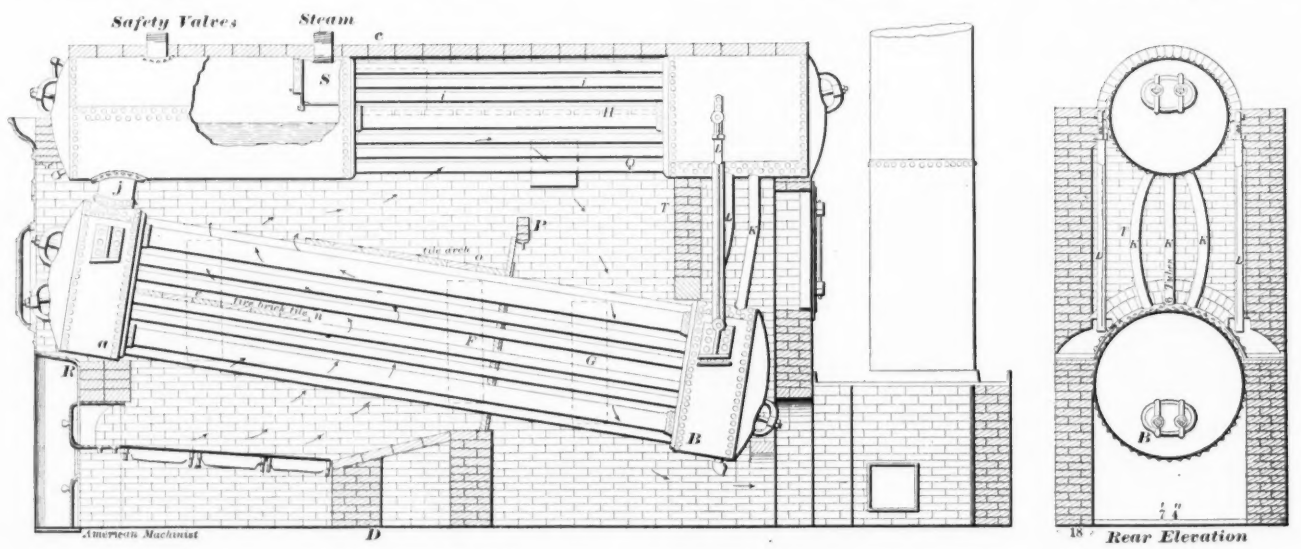
He also invented the modern American scythe, long and narrow, and stiffened by a ridge along the back, a marked improvement "for the more speedie cutting of grasse" over the broad, short, bushwack scythe made from a thin plate of steel, and richly deserved the patent for seven years which was granted by the General Court, May 23, 1655.

In 1667 he petitioned the General Court relative to a wire manufactory; and May 15, 1672, his petition for authority to coin money was refused.

The litigation to which the iron works were subjected increased and became oppressive. It appears as if the impulse to "sue the corporation" was instinctive among the townspeople. The corporation, its managers, and its workmen were proceeded against under every conceivable excuse. The boundaries of worthless land, poor crops on sterile soil, unrestrained courtships, speaking lightly of the Governor, reproachfully of the Church and harshly of the king, were all subjects of long-continued and bitter litigation. Land was sold to the corporation and afterwards further damages claimed. Dexter brought suit because the alewives did not come into his net below the dam as of yore, and Hawkes sued because the water rose too high above the dam. The town sued the corporation for pew rents in a meeting-house several miles distant, and notwithstanding the immunity in the act of October 14, 1645, already quoted in part, won the case. The pews could not have been worn much, for the courts took action against the managers for not attending public worship.

The works are not known to have been in operation after 1688, when the tract had diminished to six hundred acres and passed into individual ownership. If the supply of bog-iron ore had been sufficient for the works, they would undoubtedly have been continued the same as other enterprises of that day in various parts of New England. The immediate return to those engaged in the enterprise is now of little moment, but the results to the whole colony of an establishment which attracted, developed and then scattered a body of skilled mechanics, were of great importance, and no doubt may have been an essential factor in rearing many prominent industries.





THE HENSHALL WATER TUBE BOILER.

The Henshall Water Tube Boiler.

With this we give illustrations of the Henshall improved patent safety water tube boiler. It consists of an upper and lower section. The latter is made up of two drums, *a* and *B*, large enough to admit a man, water tubes, and two large brace tubes riveted into the tube sheets. The upper section consists of two steam drums connected by water tubes in the lower half and by superheating tubes in the upper half. The superheating tubes connect with a separate compartment *S* in the front drum, to which the steam pipe is attached. The two sections are connected by a neck *j* between the two front drums and by several spring tubes *K* between the

two rear tubes. Neither section is suspended from a frame, but by brackets, riveted to the end drums, resting on the walls. The front is made with a recess, or set back so that the fire door arch extends beyond the tube sheet, thereby protecting it and the rivets of the seam from the direct action of the flame.

Fire-brick tiles are set between the tubes, as shown at *e*. Checkers through the space between the tubes extend upwards from the back end of the bridge wall, an arch of tiles butts against these checkers as shown at *o*, and extends forward over the tubes, thereby forcing the flame to take a back-and-forth passage around the tubes in the lower section and upwards around the tubes in the upper section, after which the cooler particles of combustion are drawn down—under the rear drum—and pass out to the chimney.

The wall *T* extending from the lower rear drum to the upper one, directly in front of the spring tubes, protects the latter from the flame, thereby preventing an upward current of water in these tubes, so as to avoid all interruptions of free circulation.

The circulation of water is from the rear drum *B* through the inclined tubes to the front drum, then through the neck to the upper drum and horizontal water tubes, and from thence down the spring tubes to the lower drum *B*.

The steam, after disengaging itself from the water in the upper drums, passes through the superheating tubes to the compartment *S*.

The feed water is introduced into the rear drum *B*, the coolest part of the boiler, where a large part of the impurities of the water will naturally settle, and from whence they can be blown out. It is claimed that this boiler has a very rapid circulation, thereby increasing its evaporative capacity. It is a safe boiler, with a comparatively small weight and volume for powers equal to that of common or cylindrical boilers, and possesses great reliability in its details of structure.

These boilers are well adapted for puddling or heating furnaces in steel works, where the requirements are frequently very severe. Many are now used in modern steam plants, and have proved themselves to be safe, efficient, economical and durable boilers, and giving rapidly a steady supply of dry steam at any desired pressure. These boilers are built by the Tremont Engine and Boiler Works (incorporated) Tremont, Schuylkill Co., Pa.

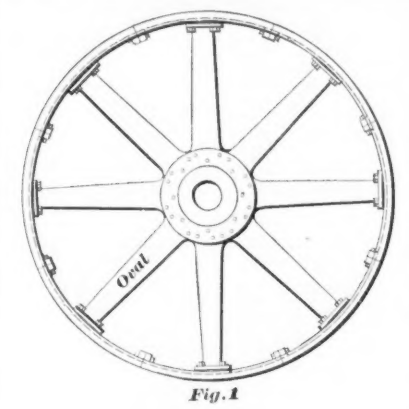


Fig. 1

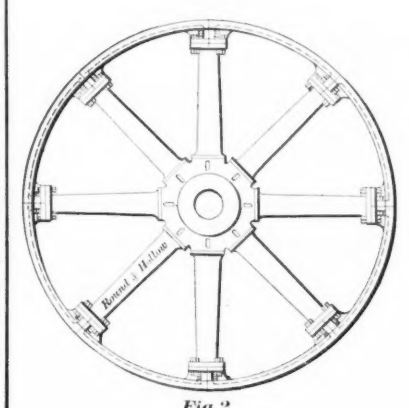


Fig. 2

Fig. 3

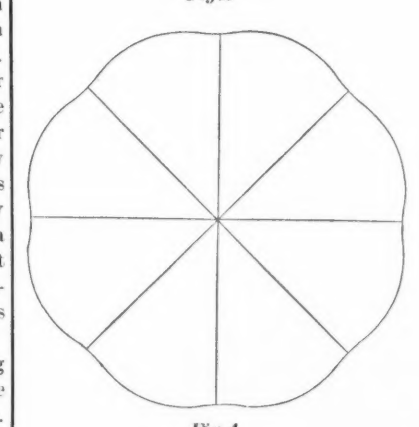


Fig. 4

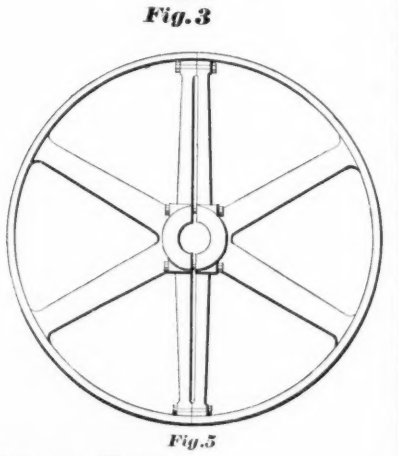


Fig. 5

STRAINS IN THE RIMS OF FLY-BAND WHEELS.

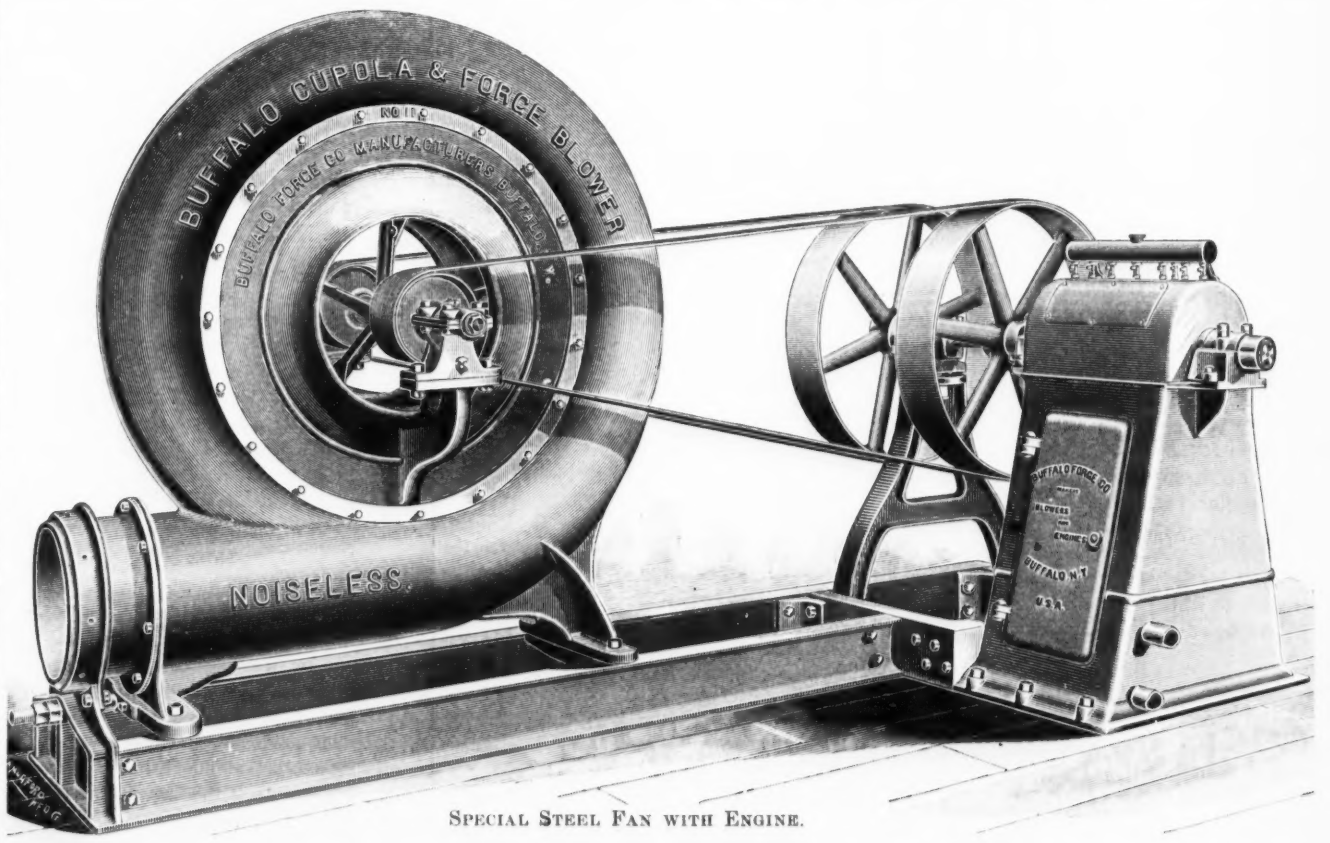
Special Steel Fan with Engine.

We present with this an engraving of a special fan and engine for use on shipboard for supplying air for forced draught, and for ventilating the holds. In such service, where air must be delivered at comparatively high pressure, the fan is made proportionately narrow, but large in diameter, this being found best for several reasons, among which is that the rotative speed is not required to be so high.

The engine is upright, and, where it is to be used in dusty situations, has its working parts entirely inclosed, as shown.

The engine frame is rectangular, wider at the base than at the bearings. In the larger sizes the cylinders are bolted to the base, which forms a part of the housing, and they are so arranged that the piston can be readily removed by withdrawing the bolts of cylinder head, and lower end of connecting rod, whereby the crosshead, cylinder head and piston can be lifted out without removing any other part. The steam chest is bolted to the cylinder, that it may be easily removed when desired. The crosshead slides are so joined to the frame as to permit adjustment, for wear. The crossheads have magnolia metal gibs, to prevent cutting of slides, and have clamp joints for the piston rod. The pistons are of the snap ring pattern, the rings of which are made of special metal (some having been used for a long time without internal lubrication). The valve is of the piston type, steam being admitted at center. The rods have large wearing surfaces, crank end is lined with magnolia metal, and the wrist end has phosphor bronze boxes with wedge adjustment. The crank end adjustment is similar to that of the marine engine. The shaft is of crucible cast steel, the cranks being opposite each other, and the eccentric is cast centrally between. By specially arranged jigs, these cranks and eccentrics are turned so that their relative positions are such as to give the proper position to the valve at various points of the stroke. The eccentric strap is lined with babbitt; the bearings are bolted to the main housing, and lined with a special brand of babbitt metal, and fitted with an improved oiling ring.

While every portion is made as compact as possible, yet the arrangement is such as to give ready access to all parts of the engine without disturbing others. The stuffing boxes are provided with nuts, which screw onto the glands, and while standard packing is employed, if so desired, approved metallic packing may be substituted. To prevent corrosion, brass glands are used for the rods; the valve rod is of steel, and fitted with hardened pin and clamp joint. The steam chest head has a phosphor bronze bushing to form a guide for the valve rod. The eccentric rod has means for adjusting valve without removing cover. No rocker or its substitute is used, the object being to reduce the engine details to the fewest possible number—a great advantage in all high-speed engines. A hand-wheel on the shaft, that the engine may be thrown off the center, is provided. Our readers are, of course, familiar with the effects of forced draught in marine boiler furnaces as regards increased capacity, or reduction of room required for a given capacity. The manufacturers of this machine are the Buffalo Forge Co., Buffalo, N. Y.



SPECIAL STEEL FAN WITH ENGINE.

It is said that there is to be a new flag for the navy.

Strains in the Rims of Fly-band Wheels Produced by Centrifugal Force.*

BY JAMES B. STANWOOD.

The strains developed in fly-wheels and pulleys are of an extremely complex nature, so that the numerous rules and formulæ employed for proportioning them are almost entirely empirical in character. Experience and judgment have dictated largely the thickness of the rim, while the eye has played an important part in determining the shape and taper of the arms.

In text books on machine design are found analyses of the strains in pulley arms due either to the pull of belt, the inertia of the rim, or the centrifugal pull on the arms due to weight of rim, etc. These text-books also state that the strength of the rim is not affected by its thickness as regards centrifugal force; for with an increase of thickness there goes an increase of weight, with a corresponding increase of centrifugal force and area of cross-section to resist it. From this reasoning, wheels of good metal, perfectly true and in good running balance, are only limited in speed by a periphery velocity, roughly assumed at about a mile per minute, or 88 feet per second; a speed giving a very low strain per square inch of rim—to wit, about 800 pounds per square inch of rim cross-section.

Yet, in view of these statements, we find wheels bursting at low speed, others running safely at high speed.

In saw-mill practice, where belts travel at high speed, bursting pulleys have given so much trouble that heavier rims and arms for this service have become common when cast-iron wheels are used. Sometimes even solid disk wheels are employed.

In electric lighting plants many receiving and tightening pulleys have failed, causing serious or casual disaster, according to circumstances.

Within a few years very large fly-band wheels, with wide, thin rims, have taken the place of fly-wheels with square rims, and have also been operated at very high speed. The writer knows of one case where the periphery velocity on a 17-foot 9-inch wheel is over 7,500 feet per minute.

In band saw-mills the blade of the saw is now operated successfully over wheels 8 and 9 feet in diameter, at a periphery velocity of 9,000 to 10,000 feet per minute. These wheels are of cast iron throughout, of heavy thickness, with a large number of arms. Who would dare to operate an ordinary 9-foot pulley at that speed?

In shingle machines and chipping ma-

*Paper read at the New York Meeting of the A. S. M. E.

chines, where cast-iron disks from 2 to 5 feet in diameter are employed, with knives inserted radially, the speed is frequently 10,000 to 11,000 feet per minute at the periphery.

In view of the disasters so common of late to large band fly-wheels running at slower speed than these, it seems probable that the strains set up in wheels by centrifugal force have not been fully considered.

Last spring the writer was one of three experts called in to decide upon the cause of a serious fly-wheel accident. From the testimony submitted by a well known builder of large wheels, he was led to investigate a special strain developed by centrifugal force in band wheel rims. This strain is due to the fact that all materials have elasticity, and stretch when under strain. The wheel in question was 22 feet in diameter, 50 inches face, and had a periphery speed of 5,000 feet per minute. It was built in sections, as so many large wheels usually are (see Fig. 1). The segments were secured to arms in such a manner that the segmental joints lay half way between the arms. This construction was criticised by the aforesaid builder, who indicated by a sketch (see Fig. 2) a better method. This formed the starting point for the investigation, which the writer wishes to submit for discussion.

A thin annular ring (Fig. 3) one inch wide and t inches thick, revolving about a central axis A, is subjected to a simple tensile strain, similar in every respect to that found in a boiler shell, its amount per square inch T being $\frac{V^2}{10}$, when V equals velocity of rim, in feet, per second. This can be shown as follows:

Let r = radius of ring in inches.

R = " " " feet = $\frac{r}{12}$.

V = velocity " " " per second.

The tensile strain T in pounds per square inch of rim section, due to bursting pressure per square inch p, with a ring thickness t in inches, is

$$T = \frac{pr}{t} \qquad (1)$$

Each pound weight of ring exerts a bursting pressure due to centrifugal force =

$$\frac{V^2}{32.2\ R} \qquad (2)$$

or for each inch in length of ring it will be

$$\frac{V^2}{32.2} \times \frac{12}{r} \times .261\ t = p \qquad (3)$$

substituting in (1) we have:

$$T = \frac{\frac{V^2}{32.2} \times \frac{12}{r} \times .261\ t \times r}{t} = \frac{V^2}{10} \text{ nearly} \qquad (4)$$

Under this strain the ring expands. If C be taken as the modulus of elasticity, this expansion will amount to $\frac{.314\ V^2\ d}{C}$ in the circumference of the ring.

If arms are inserted in the ring, and are supposed at first to have no weight and to be rigid, with no elasticity, their effect will be to pull the expanded ring into its original diameter at the arms. It will then have the form diagramatically exaggerated, as shown by Fig. 4.

Under these conditions what will be the strain upon the ring? The ring between each arm resembles now a uniformly loaded rectangular beam fixed at both ends; it is also under a tensile strain of $\frac{V^2}{10}$ pounds.

The greatest strain in pounds per square inch F to which any fiber is subjected can be expressed generally thus:

$$F = \frac{pl^2}{2t^2} + \frac{V^2}{10} \qquad (5)$$

where l represents in inches the distance from center to center of arms, p the uniform load in pounds per square inch on the length l, and t = thickness of rim in inches. The width is assumed to be unity.

This formula can be expanded by substituting for p its value $\frac{V^2}{32.2} \times \frac{24}{d} \times .261\ t$ (from 3) where d = diameter of ring in inches = $2r$, and for l its value $\frac{3.14\ d}{N}$ (6) where N = number of arms. Then

$$F = \frac{\frac{3.14^2 d^2}{N} \times \frac{V^2}{32.2} \times \frac{24}{d} \times .261\ t}{2\ t^2} + \frac{V^2}{10} \qquad (6)$$

$$= \frac{.95\ d\ V^2}{N^2\ t} + \frac{V^2}{10} \qquad (7)$$

$$\text{or } F = V^2 \left(\frac{.95\ d}{N^2\ t} + \frac{1}{10} \right) \qquad (8)$$

$$\text{or } t = \frac{.95\ d}{N^2 \left(\frac{F}{V^2} - \frac{1}{10} \right)} \qquad (9)$$

But the ends of the arms do not remain rigid; the arms themselves expand longitudinally under the influence of their own centrifugal force, and they are also elongated by the strain outward imposed upon them by the expanding ring. In fact, a compromise is effected; the arm stretches out to the ring, the ring yields in towards the arm, and the bending action in the ring depends upon this undeterminate amount. It appears, therefore, that the strain F cannot equal the value as derived by Equation (8). By a careful comparison of rim thicknesses, as determined by Equation (9), with good practice t is found to be too large. On the contrary, $\frac{t}{2}$ gives consistent results, and reasonably so, for roughly the arms can be assumed to expand one-half of the amount that the ring expands diametrically. When the arms are few in number, and of large cross-section, the ring will be strained transversely to a greater degree than with a greater number of lighter arms. To illustrate the necessary rim thicknesses for various rim velocities, pulley diameters, number of arms, etc., the following table is submitted, based upon the formula

$$t = \frac{.475\ d}{N^2 \left(\frac{F}{V^2} - \frac{1}{10} \right)} \qquad (10)$$

This is half the value given by (9), and the value of F is taken at 6,000 pounds per square inch.

THICKNESS OF RIMS IN SOLID WHEELS.

Diameter of pulley in inches.	Velocity of rim in feet per second.	Velocity of rim in feet per minute.	No. of arms.	Thickness in inches.
24	50	3,000	6	$\frac{3}{16}$
24	88	5,280	6	$\frac{5}{16}$
48	88	5,280	6	$\frac{5}{16}$
108	184	11,040	16	$2\frac{1}{16}$*
108	184	11,040	36	$\frac{1}{16}$*

If the limit of rim velocity for all wheels be assumed to be 88 feet per second, equal to 1 mile per minute, F = 6,000 pounds, the formula becomes:

$$t = \frac{.475d}{.67\ N^2} = 0.7\ \frac{d}{N^2} \qquad (11)$$

When wheels are made in halves or in sections, the bending strain may be such as to make t greater than that given above. Thus, when the joint comes half way between the arms, the bending action is similar to a beam supported simply at the ends, uniformly loaded, and t is 50 per cent. greater. Then the formula becomes:

$$t = \frac{.712d}{N^2 \left(\frac{F}{V^2} - \frac{1}{10} \right)} \qquad (12)$$

or for a fixed maximum rim velocity of 88 feet per second, and F = 6,000 pounds,

$$t = \frac{1.05d}{N^2} \qquad (13)$$

It is a fact that wheels do spring out at the joint when cast in halves or sections; for the writer has frequently tested them when they have shown this state of affairs. For this reason the construction for segmental wheels shown by Fig. 2 is preferable to that shown by Fig. 1.

Wheels in halves, if *very thin rims* are to be employed, should have double arms along the line of separation (Fig. 5). Compare the thickness of the rim of a wheel made in segments or in halves, the joint half-way between the arms (Fig. 1), with the thickness of the rim as constructed in Fig. 2. For example, take a 20-foot wheel at 88 feet rim velocity per second, with 10 arms. When constructed according to Fig. 1 t must be $2\frac{1}{2}$ inches; according to Fig. 2, $1\frac{11}{16}$ inches.

Attention should be given to the proportions of large receiving and tightening pulleys. The thickness of rim for a 48-inch wheel (shown in table), with a rim velocity of 88 feet per second, is $\frac{5}{16}$ inch. This should be carefully noted. Many wrecks have been caused by the failure of receiving or tightening pulleys whose rims have been too thin.

A word of caution should be given to engine builders and engineers. Wheels may be specified to be made too light in weight; for with a given diameter and weight there is a minimum safe weight, dependent upon the principles already set forth. Fly-wheels calculated for a given coefficient of steadiness are frequently lighter than the minimum safe weight. This is true especially of large wheels.

A rough guide to the minimum weight of wheels can be deduced from our formulæ. The arms, hub, lugs, etc., usually form from one-quarter to one-third the entire weight of the wheel. If b represent the face of a wheel in inches, the weight of the rim (considered as a simple annular ring) will be

$$w = .82\ dtb \text{ pounds} \qquad (14)$$

If the limit of speed is 88 feet per second, then for solid wheels

$$t = 0.7\ \frac{d}{N^2} \qquad (11)$$

For sectional wheels (joint between arms)

$$t = \frac{1.05d}{N^2} \qquad (13)$$

Substituting in (14) we have: weight of rim for solid wheels,

$$w = \frac{.57\ d^2\ b}{N^2} \text{ in pounds} \qquad (15)$$

Weight of rim in sectional wheels with joints between arms:

$$w = \frac{.86\ d^2\ b}{N^2} \text{ in pounds} \qquad (16)$$

Total weight of wheel: for solid wheel,

$$W = \frac{.76\ d^2\ b}{N^2} \text{ to } \frac{.86\ d^2\ b}{N^2} \text{ in pounds} \qquad (17)$$

For segmental wheels with joint between arms:

$$W = \frac{1.05\ d^2\ b}{N^2} \text{ to } \frac{1.3\ d^2\ b}{N^2} \text{ in pounds} \qquad (18)$$

This investigation has not the advantage of extreme accuracy, but it tends to show a relation which ought to be observed. The constants used may be modified by further experience.

The value of F = 6,000 pounds is taken at one-sixth of Rankine's ultimate breaking strength of cast-iron when under transverse strain. The factor of safety is, therefore, 6. It should be remembered that in wheels this factor can be rapidly diminished; thus the strain varies nearly as the rim velocity squared, and if the velocity is doubled the strain is quadrupled, and the factor of safety is reduced from 6 to less than 2.

* These are the calculated thicknesses for a band saw-wheel 9 feet in diameter with 390 revolutions per minute. The actual thicknesses as made were found to be $2\frac{1}{16}$ inches with 16 arms, and $\frac{3}{4}$ inch with 36—$1\frac{1}{16}$ inches steel arms.

Meeting of the A. S. M. E.

The American Society of Mechanical Engineers met in regular session at the house of the society, 12 West 31st street, this city, at 8:30 P. M., Nov. 29, with President Chas. H. Loring, U. S. N., in the chair. After a few introductory, congratulatory and welcoming words the president delivered the following presidential address, entitled

THE STEAM ENGINE IN MODERN CIVILIZATION.

The great historian who looks back a century hence upon the present era, with its numerous ramifications condensed by time into one focus, wherein the smallness of the field and the intensity of the light enables him to see plainly what we now only dimly discern, will point out that the great underlying cause of the wonderful progress made by mankind during the last hundred years was the steam engine.

And why should this particular machine have produced such amazing results?

Many other machines which preceded and accompanied its development are quite as ingenious mechanical combinations and involved quite as much knowledge and skill in their conception and construction as the steam engine, but the effects of which were, comparatively, both local and trivial, producing scarcely a ripple on the current of human affairs. Had they never been, the world would have lost but little.

The answer is that the steam engine, with all its simplicity, is, what no other machine ever was, the creator of physical power, and this to so enormous an extent, at so small a cost, in so portable a form, and with such convenience of application, that it speedily revolutionized the economy of labor, and in so doing necessarily revolutionized all the conditions of man; for they all have been dominated by the labor question—the great bread and butter problem—since the primal curse was branded on the brow of the first man. It was to the relief of all mankind, in the struggle to find what to eat and wherewithal to be clad, that the immortal inventor of the steam engine gave to the world the finest solution of the problem it can ever hope to receive.

He builded wiser than he knew.

He retired contented with the profits of his invention, and died without dreaming that he had placed on earth an infant Hercules whose club, with an ever-increasing might, would batter down the institutions of preceding ages; whose right arm, endowed with an ever-increasing power, would erect those of succeeding ages on foundations as different as strength differs from weakness, making possible the wonderful development of the man of the past into the man of the present.

All that man has, he has obtained from the earth, and is the direct product of physical labor, and the sum of his possessions is directly as the quantity of this labor expended. So long as this was manual labor, his possibilities were limited by the number of men available.

Here was the barrier that confronted the man of the past, and, until the advent of the steam engine, progress was necessarily difficult and slow; and the little which was made in the centuries during which he had plodded upon earth was local, confined to few localities, and at the expense of progress elsewhere.

The civilizations of antiquity were limited to a few cities, and were based upon slave labor, the slaves being drained from other places, which were thus doomed to deepening barbarism.

The limit of possible slavery was the limit of the ancient civilization. When the maximum number of slaves who could be advantageously supported on any particular territory was reached, civilization stopped, except where direct robbery of other territory enabled it to maintain a fatuous existence; and the limit here was soon reached, for this was a system of "killing the goose that laid the golden egg."

The disgrace of the ancient civilization was its utter want of humanity. Justice, benevolence, and mercy held but little sway; force, fraud, and cruelty supplanted them. Nor could anything better be expected of an organization based on the worst system of slavery that ever shocked the sensibilities of man. As long as human slavery was the origin and support of civilization, the latter had to be brutal, for the stream could not rise higher than its source. Such a civilization, after a rapid culmination, had to decay, and history, though vague, shows its lapse into a barbarism as dark as that from which it had emerged.

Modern civilization also has at its base a toiling slave, but one differing widely from his predecessor of the ancients. He is without nerves, and he does not know fatigue. There is no intermission in his work, and he performs in a small compass more than the labor of nations of human slaves. He is not only vastly stronger, but vastly cheaper than they. He works interminably, and he works at everything; from the finest to the coarsest, he is equally applicable. He produces all things in such abundance, that man, relieved from the greater part of his servile toil, realizes for the first time his title of Lord of Creation. The products of all the great arts of our civilization, the use of cheap and rapid transportation on land and

water, and of printing, density of population everywhere, the instruments of peace and war, the acquisition of knowledge of all kinds, are made the possibility and the possession of all by the labor of this obedient slave which we call steam engine. He is no product of nature, but purely the creation of art alone. He works for all alike, and he works forever. His labor fills the earth, and makes manifest the latent virtues and intelligence of our race. The immense ameliorations of modern society are due to the same cause; and so great is the beneficence, that, without irreverence, the steam engine may be truly called the material saviour of man.

We who were born under this benign influence but vaguely appreciate its value, and rarely recognize our obligations to it; existing civilizations would be impossible without it, and if human ingenuity finds no substitute for it they will perish with it.

The steam engine is a machine which has been the prolific parent of other machines. It has caused the invention and construction of the immense plant of ingenious power tools employed in its own fabrication; it has caused the improvement of metallurgy as a science and of the various methods of metal manufacture as an art; it may be said to have created whole branches of important manufactures, and to have been the occasion of the invention of the immense mass of highly diversified machinery by means of which these manufactures are practiced; and, last and greatest, it has stimulated and directed the human intellect as nothing else ever has, and has done more to advance human nature to a higher plane than all which statesmen, generals, monarchs, philosophers, priests, and artists have ever accomplished, in the vast interval which separates original man from the man of to day. It has raised man from an animal to something approaching what a great intelligence should be, by simply placing in his hands a limitless physical power capable of application in every conceivable direction and to every conceivable purpose.

These words are no extravagant encomium; they are a simple statement of momentous facts, which, however, the mass of mankind seems so little to understand and appreciate, that I have ventured to give them record in a humble endeavor to prevent their being entirely overlooked, and with a hope of their eventual recognition.

Contemporaneous historians have but scantily drawn attention to the immense influence exerted upon modern history by the steam engine. They follow in the same well-worn ruts, giving dubious descriptions of battles, names of monarchs and of statesmen, lists of decrees and laws, no end of political negotiations and intrigues, and the whole array of puppets who seem to push the car of time, while they are only flies upon its wheels. The real shaping cause of the march of modern events and of the great industrial progress of the times has but trivial recognition in the literature which pretends to account for what has happened, or to predict what may ensue. One of the peculiarities of the genesis of the steam engine is, that it seems to have been more in the nature of a creation than of an evolution; for it was carried by its inventor, both as regards principles and practice, to a wonderful state of completeness. Very little has been added by his successors to his mechanical details or his various combinations of them. The invention seems to have nearly realized the birth of Pallas. The only modification in which he was not concerned is that of using the same steam in successive cylinders of increasing capacities, thus forming what may be termed, for the sake of distinction, the multiple-cylinder engine, as opposed to the single-cylinder engine. The original multiple-cylinder engine of Hornblower, brought out in 1781, and since known as the compound engine, and, by extension of the principle, as the triple-expansion engine and the quadruple expansion engine, had thus a beginning almost coeval with the single-cylinder engine of Watt. After much litigation it was declared to be an infringement on Watt's patents covering the use of steam expansively, and it passed out of use. It did not, in fact, give any economic gain over the single-cylinder engine, as the pressure of the steam was the same in both, and only a few pounds above the atmospheric pressure, limiting the measure of expansion for maximum economy to about one and a half times. With this low pressure of steam, and for the small powers used in those days, there was no mechanical difficulty in developing the whole power in one cylinder with all the economy possible. To obtain higher economy, higher pressure was a necessity, and pressure is solely a question of boilers. At that time the art of boiler making was so inchoate that sufficient strength of generator could not be obtained for greater pressure, and the development of the steam engine could not progress much, if any, faster than the art of boiler making; in fact, no one improvement in mechanics can advance much beyond the general front of what may be termed the industrial progress of the age. Aided by the improvement in the boiler maker's art, the conspicuous advance which has been made with the steam engine is the direct result of the higher pressures of steam used.

The economic necessity for employing these higher pressures has brought into vogue again the multiple-cylinder engine, which enables the steam to be used with a regimen not practicable with the single engine, and this regimen is attended with enormous economic gains. In the first place, what may be termed a "given quantity of pressure"—that is to say, the product of a given weight of steam by its pressure—is larger proportionately to the heat required to evaporate that given weight, the higher the pressure at which it is evaporated. The heat per pound of water vaporized from a given temperature, it is true, increases with the pressure, but the *quantity* of pressure produced under the greater pressures by a given quantity of heat increases in a higher ratio. The gain thus derived in the production of the pressure is very considerable.

Taking 50 pounds per square inch above the atmosphere as that usual with single engines of anything above small dimensions, and 150 pounds above the atmosphere as an easily worked pressure with multiple-cylinder engines, the gain in heat by the higher pressure used is about one-twelfth; a significant amount, but much less than what is additionally gained by the advantageous use of a greater expansion of the steam made possible by the greater pressure.

With the 50 pounds pressure, no gain is obtained by expanding the steam more than about three times, while with the 150 pounds pressure the expansion can be advantageously carried to about six times.

The result of both these economies is, that the multiple-cylinder engine of the triple-expansion kind produces the horse-power with about two-thirds the coal that the single-cylinder engine does. Or, otherwise expressed, the single-cylinder engine, under the given conditions, would require about fifty per cent. more fuel for a given power than the triple expansion engine. These are the mean figures for ordinary practice, which may be varied considerably for extreme and exceptional cases. The gain would be much greater than stated, were it not that the higher pressure is accompanied by higher temperature, and therefore the gases of combustion must leave the boiler at a correspondingly higher temperature. Thus the economic vaporization of the boiler is less with the 150 pounds pressure than with the 50 pounds. Obviously, too, the higher temperature is accompanied by greater heat radiations from all steam surfaces, and the higher pressure by greater steam leakages past the valves and the pistons of the cylinders.

If the original steam engine was the greatest boon mankind has ever received, an increase of its value by one-third over its best development should add proportionately to the benefaction; and such is the industrial effect of the modern steam engine in its most advanced stage. The engineering world has "improved upon its heritage and vastly bettered its instruction." But it cannot proceed much further on the same lines, for with much higher pressure than has been already used the temperature of the steam would be too great to permit the metals to work satisfactorily on each other, while all the deducting losses would increase in a more than corresponding ratio.

The consequences of decreasing the cost of power by so large a fraction as one-third are very far-reaching, far beyond the mere cheapening to that extent of products already manufactured; for it allows other manufactures and other great works to be undertaken, which, with the reduced cost of power, become remunerative, but which, at a higher cost, would not have been undertaken. The benefits of cheapening power increase in a geometrical ratio; they radiate as from a center.

This great improvement in the steam engine, adapting it to higher possibilities and greater radius of action, has carried with it all matters germane to it, and not the least among these is the enormous impetus and extension which it has given to mechanical science and art everywhere, making the engineer, by whatever name or title his specific work may designate him, the most potent factor in the world's progress, and "in the great work"—quoting from one of my eminent predecessors—"of emancipating mankind from the trammels of his animal nature."

Following as a natural sequence this recital of the potent influence of the steam engine upon man's social and physical conditions comes the question: Is it to continue as the great power-producing machine of the future? Can the inventive mind of man and his artful hand bring into being any other device as a substitute for it, that will do its work cheaper, better, and more handily?

To give answer to this is to say how it can be done, and as yet none is ready with a reply. Without doubt there are still "more things in heaven and earth than are dreamed of in our philosophy," but in the contemplation of a solution of this question, that already dreamed of is the limitation of our resource. Already we are beginning to avail ourselves of the enormous energy of waterpower, now going to waste, through the convenience of electrical transmission and distribution, and the hand of the "Wizard" has drawn faint electrical energies direct from the combustion of fuel.

The winds and the tides and the rays of the sun have locked up within themselves enormous stores of power, waiting, perhaps, for the ingenuity of man to unbind and convert them to his uses.

But, when all shall have been realized which these as yet unused resources offer to man, when all man's present knowledge shall have ended in fruition, the steam engine, from its portableness, its convenience of application, and its self-containedness, will still remain man's valued servant, the grandest conception of the human mind, the great conservator of the human race.

At the close of the president's address the members adjourned to the banquet room, where a light lunch was partaken of, this rite partaking largely of the character of a social reunion.

At the opening of the second session, at 10 A. M. of the 30th, the first business transacted was the receiving of reports from committees, etc. The council reported that arrangements were being made for a permanent record and exhibition of the patents granted to members of the society, these to be recorded and indexed, and, where possible, copies of the patents and models kept on file at the society's house.

The rent paid by the society for the use of the house to its owners, the Library Association (composed of members of the society), had been raised from $2,200 to $3,000 per annum, in view of increased accommodation afforded to the society, some of which, as shown by another report, is made a source of revenue to the society.

It had been decided to have two committees to act for the society in the matter of extending courtesies and facilities to European engineers. One of these committees was to confer with committees representing other engineering associations, to have the direction of such hospitality as it may be practicable to extend to visitors at the house, and to see that persons competent to converse in the various European languages were present to give such assistance as may be useful. The second committee is to have charge of matters pertaining to the proposed or hoped for visit, in a body, of English and French engineers, of whom the American engineers that visited Europe in 1889 were the guests. This entertainment, it is understood, will be mainly at Chicago, and for the purpose $1,500 of the $3,000 needed had been subscribed.

The council also proposed for action by the society an amendment to the rules giving the council power at discretion to remit the annual dues of members of at least ten years, membership in good standing, who might, through ill-health, misfortune, or other causes, have become unable to pay them.

An interesting part of this report, in view of the fact that this is the first year of the society under the increased initiation fees and annual dues, was the fact that there had been 180 members admitted during the year—more, as the president had stated previously, than in any previous year except one, and that the membership was now 1,569.

The report of the finance committee was a very gratifying one, the receipts during the year having been over seventy per cent. more than last year, which had enabled some arrearages to be paid up, and had left a balance of $1,628 on hand. A feature of this report to which special attention was called was the very small per cent. of arrearages for dues, this being attributed to the fact that the council regarded this from a purely business standpoint, and drew upon members at the expiration of the specified limit of time, the same as they would for any other business claim.

Mr. C. W. Nason, for the Committee on Standardization of Pipe Flanges, reported progress, and submitted some of the conclusions to which the committee had arrived, tables of proposed dimensions being submitted for discussion by the members, with the invitation to communicate with the committee. It is thought this committee will be ready for a final report by the time of the next annual meeting.

The Committee on Standards, which was appointed soon after the Erie meeting, as a result of a paper by Mr. James W. See, made a report in the form of a letter from that gentleman, in which he said that, in the effort to have the U. S. Congress establish a bureau or depository of standards, the matter had been referred to the Committee of the House of Representatives on Patents; that individual members of that committee, including its chairman, had declared themselves in its favor, and had promised action upon it, but that no action was taken, and Mr. See had come to the conclusion that it would be impossible to secure any action by Congress upon a matter in which there was so little politics, and so little of general interest. He asked that the committee be discharged, which was done.

The Committee on Standard Units also asked to be, and was, discharged.

The report of the tellers of election was read, the officers for the ensuing year being Ecley B. Coxe, Drifton, Pa., president; C. W. Hunt, New York City, Thos. R. Pickering, Portland, Conn., and Edwin Reynolds, Milwaukee, Wis., vice presidents; Wm. H. Wiley, treasurer; F. R. Hutton, secretary; and Chas. H. Manning, Manchester, N. H., John Thompson, New York City, and C. W. Pusey, Wilmington, Del., managers, whose terms expire in 1895.

Mr. Jesse M. Smith, delegate to a committee of the engineering societies, reported that the Engineering Congress, to be held at Chicago, had been divided into six sections, of which Civil Engineering was the first, and Mechanical Engineering the second. The meetings were to be held in a new building, not far

(*Continued on page 9.*)

LETTERS FROM PRACTICAL MEN.

A Machinist's Duty to Himself.

Editor American Machinist:

In your issue of November 10th I mentioned a good combination of brain and muscle and a *disposition* to work both to advantage. There are a great many machinists who have this good combination of brain and muscle, but owing to a misunderstanding about working both to their own best advantage, they are continually working an injustice to themselves and to their fellow-workmen. I say a *misunderstanding*, and I will try to explain about where this misunderstanding comes in. To make my meaning clear I will tell two of the many incidents I have seen bearing upon this matter. A young man who was in the habit of doing considerable thinking about his work, one day got considerable of a lecture from other workmen in that shop on account of his using a certain improvement of his own in doing some of the regular work. The argument was this: This piece of work was one that was quite common in this shop, about all the men having a chance at it in their turn. Now if this man made any improvement they would all be expected to either use his improvement or get up one of their own equally good. It was said that the employer was satisfied with the way things had been going, and that any change was uncalled for.

Again, a workman was doing a piece of work on a milling machine. This work was new to him, but to others in this shop it was a "cut-and-dried" thing. There was one part of the job that necessitated a change from a small cutter to one of larger diameter, and when this change was made the speed of machine must be reduced. This new man was in the habit of using judgment. He could see plain enough that to reduce the speed of machine and leave the feed belt where it was would be to do less work with the large cutter than with the small one. A look at the feed cones told him plainly enough that that belt had run in one place for years, but he paid no attention to this, but put it where he thought it should be. Men came to him and complained that if he did this they would all be expected to do it.

It is not necessary for me to tell more of such incidents, for those who work in machine shops know all about it, but I say there is a misunderstanding. A man working in most machine shops is situated about the same as men at any other work in the world. His success depends upon how well he can do, and it is his duty to himself that he learn what is right to do, and then that he do it, regardless as to whether anybody else likes it or not. When a man gets into a shop that is controlled by such old "fogy" notions as these I have mentioned, or where the management or, what would be nearer correct, mismanagement, has brought about a state of affairs as bad or worse, the best thing that man can do, if he wants to improve himself, and in so doing his prospects in life, is to shake the dust of that shop off himself and look for a place where common sense is the rule.

To be a good fellow is one thing, but to disregard one's own best interests, and to hold one's self in check to accommodate some one else who either does not want to make progress or is too lazy to do so, is quite a different thing. In a machine shop there are certain laws governing the running of machines and the working of men, that are not devised by man, although some try hard to improve them.

A machinist should be well acquainted with these laws, and when he obeys them to the best of his ability he does about as well as can be expected.

In running a machine tool the law that governs the speed, feed, and method of holding the work is what the cutting tool will well stand, the power of the machine, and the strength or other features about the work. The law that governs the amount of work a man should do is what he can well do without becoming too weary. In fact, a regular six-days-in-the-week speed and fifty-two weeks to the year if necessary. These laws are among the things that a man in learning the machinist trade should learn. There is a chance to excel in this direction. When you are sick you go to a doctor because you expect him to know something about your complaint, and it is just so when a man hires for a machinist; he is expected to know something about the laws governing the running of machines and the working of men.

When a good foreman sees a man running a machine on a feed much slower than it will well stand; he knows that that man either does not know or else he has no disposition to do as well as he knows; one is as bad as the other.

Some shops have adopted rules for governing these backward ones, which are hard to bear by those who really do know and are willing to do as well as they know, and so, as I said, a man can do an injustice to himself and to his fellow-workman by not obeying these laws I have mentioned. Almost anybody can run a machine at about one one-hundredth of its capacity without breaking anything, but a man who can use good judgment and run the machine to its best, one who can proportion the time of tool-grinding to machine work, so as to give the best results; one who can cut the nearest to the required size with a roughing cut, and be sure of leaving enough for finishing; one who can grind a tool for finishing, and make it work as he wants it to without "monkeying," is quite a different man, and he owes it to himself that he lets people know that he is a different man from the other fellow.

A MECHANIC.

Does It Pay to Re-cut Files?

Editor American Machinist:

This question was recently asked in these columns, and then the propounder of the question goes on to answer from his standpoint, and concludes by consigning to the past both the hand-made and re cut files; but there are some things that you cannot brush aside with a wave of the hand, and the present writer is of the opinion that hand-cut files are of that class, and this opinion has been arrived at after several years experience in supplying files in large quantities direct to the workmen in the shop, during which time the files of all first-class manufacturers of machine-cut files have been in the works, and used to some extent. You may examine a file and admire its shape, examine with a magnifying glass and note the perfection of the lines of angle as well as the shape of teeth, test for temper, and find it withstands the severest test the critical inspector can devise, but when the workman, who in all probability is working on piece-work, returns the file to the tool room with a woe-begone look on his face (at the time he has lost), and tells you it is no good, what are you going to do about it? If you try to convince him of the superior quality of the machine-cut over the hand-cut file, he will silence you with the demand for one of those hand-cut files, as he is willing to pay for the difference in the cost. That settles the matter so far as he is concerned; the man who works with the file, and pays for the same out of the work he is enabled by its aid to turn out, is entitled to have furnished to him the goods he is willing to pay for. The case cited above is no fancy sketch, but one of frequent occurrence in tool room experience.

It is a fact beyond question that in the last thirty years great advancement has been made in machinery for making files, and especially in perfecting the smaller sizes of files with the view of supplying the American market in competition with the foreign product. Improved machinery and perfected methods may in time supplant the hand-cut files to some extent, but mainly on account of the reduction in price, yet there will always be a demand for the hand-cut file. Some work on which files are used the cost of the files count for little compared to the work accomplished, and the man who wields the file is, to my mind, the best judge of its value. I venture the assertion that the advocate of machine-cut files will not claim that they are superior in quality to the hand-cut article, but that the difference in wearing qualities doesn't compensate for the difference in cost. On this point the workman at the bench or the lathe is the best judge, especially if the extra cost comes out of his wages, and I find a general preference for the hand-cut article as giving the best satisfaction.

So far as re cutting files is concerned, it may not pay to have machine-made files re-cut; but when a firm saves one-third of the cost of new hand-cut files by having the old ones re cut, and they give as good satisfaction as new ones, I don't see how there can be any loss, as the old stock is still the property of the firm, only slightly diminished in weight.

We must recognize the fact that there is as much difference in the quality of hand-cut files by the different makers as we will find in the files put on the market by different manufacturers of the machine-cut files, so that in speaking of both we take into account only the best of either class of goods. In the successful efforts of manufacturers in the past few years to cheapen products, the milling and grinding machine has played an important part, and has supplanted to some extent the old-time planer—the file—the special friend of our brethren in Great Britain, that Mr. James Arthur so pleasantly writes about in his recent article on British and American methods; but to whatever perfection the milling and grinding machine may be brought, they cannot do away with the use of files altogether, no more than they can supplant the lathe or planer; each will fit into its proper sphere, and the proper functions of each are to be determined by the growing intelligence of the mechanic.

The writer may be called an old fogy for the views advanced, but is yet of the opinion that the hand-made file maker, like the hand made boot maker, still hold first places in their respective crafts, and in either case the machine-made article is but a clever imitation.

D. D. D.

Two Experiments.

Editor American Machinist:

I would like to present to your readers a description of two experiments that I believe they will find very interesting.

If iron or steel filings be corroded in a damp atmosphere, and this rust added a little at a time to a jar of diluted sulphuric acid, the crystalline carbon particles that existed in the metal unite to form large crystals; these same will be of the hard diamond form.

If a steel file be broken into fragments, the pieces annealed and placed in a glass jar, and over these there be placed fragments of charcoal carbon and other heavier than that to hold it down, and if the jar be now filled with water, and sulphuric acid added gradually until the metal is completely removed, it will be found that the carbon of the charcoal replaced the iron, and so produced an exact copy of the file fragments; this I look upon as petrified steel.

I have specimens to show as proof.

CHARLES WETTERER.

Inventors and Patents Again.

Editor American Machinist:

In a recent issue of the AMERICAN MACHINIST there was an article by "A Mechanic" which was of great interest to me. I desire very much, however, to make some remarks upon the same subject, and from a very different standpoint. At the same time I do not wish to enter the arena of disputation, nor to be deemed as one taking up the cudgels for very vigorous action.

In the first place, I want to proclaim that there are no such beings as impostor inventors. Granted there are robbers and thieves, but there it stops. Probably what was meant by *impostor inventor* was an inventor who lacks business ability or the power of making money. Let me quote a bit of law to "A Mechanic," relating to the usefulness of an invention. "*Useful* means, not frivolous or injurious to the well-being, good policy or sound morals of society." Lowell *v.* Lewis, 1 Mason, 182. "Useful," then, is an expression indicating more the wanting of harmful qualities than the possession of great utility. When courts of the United States have so decided, is it surprising that the Patent Office should rest content that a thing is harmless, and not scrutinize it for intrinsic usefulness?

Without a doubt, the Patent Office of our country is a monument to the ineffectual effort of busy minds; but so surely as the coral islands rest upon the minute efforts of dead infusoria, the grandest inventions rest somewhere upon these futilities with which that department is lumbered. "But," says "A Mechanic," "it doesn't make money." No, not for him. Of that we will speak later.

Something is said of what inventors should learn. They should make special study; they must knock around for experience; they must learn what not to do; they must hold themselves back; they must view their work as through other eyes. In other words, they must become supernatural. Let me describe you a chapter from my own experience. A rap on the door. "Come in!" A tall fellow walks in, sits down a moment, looks around in distrust, sees the office boy, and without a word decamps in evident haste. This occurs every day for a week. Finally his errand becomes known. He has invented a huge plow, to be drawn along by great current aprons. With it he will deepen the Mississippi River, and do away with the levee system. There is inventive genius for you; but not enough *business* to sell a codfish! Let us try again.

Upon one of the shelves of the great model room there rests a little device the size of a large hand. It is for lifting steamers over bars and shallow places. Rings are screwed in the sides of the steamer, and down through these are pushed long poles, armed with shoes to prevent their sticking in the mud. Pushing down upon these, the boat is raised up and — floats over the bar? No; hangs fast on stilts. The inventor of this device in later life became a president, and bought the salvation of his country with his life. I refer to Lincoln. Pennies are small things, but make dollars These "fiddling" inventions are of *little* use, but make progress.

Now, one word as to the government prosecuting infringements. If it does this, why not prosecute personal wrongs and wrongs to property. You kick me out of my house, won't pay your rent, forget that you owe me for bread and sausage. Oh, well, that's all right. The prosecuting attorney will attend to that. If justice is an expensive luxury to the community now, what would it be then? Rest content to invoke the law, not the law invoke you. Now let us consider infringements. What are they? You steal my patented invention, make it, sell it. Do you make money? You do, if—you get upon the market before I do, if you make cheaper than I do; if you are a better business man than I am. There you have it in a nutshell. How did Thomas H. Edison get rich? Oh, he invents so many things—over five thousand in all. Not much. There would not have been a cent made out of the incandescent electric lamp, had he not devised machinery and methods of making it faster, cheaper and better than any competitor. A successful inventor *must* have a business head to reap the benefit of his work.

Since rule making for inventors seems in order, how are these? Is your invention better than some other one? Can you make it cheaper? Can you fill the market immediately? If so, employ a *good* attorney, work away, and succeed. For an invention that will stand the above test, I'll get the patent without charge, I am so confident that the inventor would succeed and reward me out of the fullness of his heart.

A LAWYER.

The Link Motion and Compressor.

Editor American Machinist:

In my communication on Link Motion, published in the AMERICAN MACHINIST of Nov. 10th, I complained of the excessive compression in the cylinder and the small port opening an engine has while cutting off early in the stroke with link motion.

The best place to see the bad results of too much compression and small port opening is in the engine room of a steamboat propelled

by a screw. On different occasions I have seen the double engine of a Chautauqua Lake single screw steamer linked up to a short cut-off with the throttle wide open, and each time the engine would fall to slow bell speed.

In the case of a locomotive being worked at an early cut-off pulling a train, the momentum of the train helps to overcome the resistance caused by excessive compression in the cylinders. But where a screw is totally submerged the momentum of the screw is of very little consequence, and no help to the engine to overcome the resistance caused by excessive compression, and in consequence slow speed is the result of cutting off early with the link. While running slow the contracted port opening is of sufficient area to admit steam of a good pressure while the piston speed is low in the case of the marine engine choked by compression linked up to a short cut-off, but where the piston speed is high a liberal port opening and drop cut-off is necessary to produce an indicator diagram that would show the steam line nearly parallel to the atmospheric line.

In the "What you want to know column" of the *Locomotive Engineering*, a knowledge seeker asks why an engine is called, "out of gear," when the reverse lever is in the center notch? The paper, in answering the question, says an engine is "out of gear" when the reverse lever is in the center notch, because the engine will move neither forward nor backward with the links suspended in that position.

There is a certain railroad that has freight engines of the consolidation type with 21" cylinders and 24" piston stroke; the valve gear of these engines is very short, consequently the mid-gear lead opening is a shade over three-eighths of an inch. I have ridden on one of these engines pulling twenty-five loaded cars and on the fastest freight run on the road, and where the road was level the engineer would cut her back into the center notch and she made the time as easy as if working one notch ahead of center; the throttle was wide open, the exhaust sounded all right, as though the cut-off was equal all around. I don't mean to say that an engine will start from a state of rest with the lever in the center notch. I paid particular attention while the engine was in the shop to see that the notch marked for the center notch was really the center notch.

HARRY CORNELL.

Conical Cam Rollers.

Editor American Machinist:

I note what Mr. Durfee says about cam rollers in the November 10 issue. He has evidently never examined Mr. Rose's "Modern Machine Shop Practice" very closely, for the conical roller is noticed there on page 84 of Vol. 1. The conical roller, it seems to me, would have some end thrust on its stud, which the cylindrical roller would not, and as Mr. Durfee's drawing shows the shoulder on the conical roller to be about as great in diameter as the cylindrical roller itself, the advantage of the conical form would appear to be that it eliminates sliding friction from the groove, and introduces it at the shoulder. Also any wear of the parts that allowed the roller and cam shaft to get further apart would alter the effective throw of the cam, and this, to my way of thinking, would about offset the alleged tendency on the part of the cylindrical roller and its cam to be "mutually destructive."

WALTER GRIBBEN.

Gears for Threading Worms.

Editor American Machinist:

Walter Gribben, in your issue of September 29, refers to cutting worms to run with gears sized by diametral pitch. In such a case we usually select gears, if possible, to cut something closely approximate.

Many modern lathes are now arranged for compounding, and any such lathe will do it very well, for by using the compound pair 28–44 with the usual change gears, any diametral pitch may be cut with a constant error of .0004" per inch of length, which may be considered correct, practically. In cutting any diametral pitch it is merely necessary to arrange the lathe for twice the pitch in threads per inch, using the above compound; thus, to cut 12 diametral pitch use gears for six threads per inch, increased by the above compound; the change gears usually provided for lathes 14" or 16" swing will cut all the regular diametral pitches from 4 to 24 inclusive, which covers most cases in actual practice. S. WRENCH.

Blue-printing.

Editor American Machinist:

In one of the back numbers of the above paper we noticed, in your "Question and Answer Column," an answer that you gave to a subscriber who had complained about being unable to get satisfactory blue-prints from the formula that you gave in your paper. Your answer to him was that if he had carefully followed the directions which you had given you could not understand why they had not turned out well.

Probably, from some experience which the writer has had, he could explain the matter a little more clearly.

At one time the writer experienced a great deal of difficulty with his blue-print preparation, which instituted an inquiry into the cause.

At first he thought the trouble originated with the potash, but after trying three or four different samples he found that the trouble was not there.

He then commenced to experiment with citrate ammonia of iron, and discovered after a few experiments that the trouble came from that. He then sought to find out whether it was because the citrate ammonia of iron was old, or whether it had been burnt in the making, or whether it was on account of different qualities. After using all the care it was possible to exercise in preparing it, he found that the iron part was old. He then called upon a friend who uses a great deal, and obtained a sample from him. This was tried, and proved satisfactory. He then purchased some of the same brand which he used, and prepared it for use, and allowed it to stand about a week or ten days, and found that it worked exactly as did the iron from which my trouble originated, and he also discovered that it had contracted mold.

After a few other experiments, and consultation with friends who were constantly using it, he came to the conclusion that the trouble which he had first experienced originated in the citrate ammonia of iron, and it had been allowed to become old and stale before using.

The writer has also noticed a number of short letters respecting tracing ink being destroyed by flies after it had been put on the tracings.

We use Higgins' prepared ink, and before using we mix with it a few drops of ox gall. We have used this preparation for quite a while on our tracing work, and have never been careful about covering the tracings during the day, and have noticed that the flies do not trouble them when the ink is thus prepared. A. H. NOURSE.

Models of Locomotives.

Editor American Machinist:

Referring to your issue of 10th inst., we note letter from T. C., of Detroit, Mich., regarding small locomotive.

We have complete patterns for two sizes—one 24" in length when finished, and the other 48". They are both for modern design of engines, and possibly we might help your correspondent to get what he wishes.

The small size we think we can furnish for about $60, as he mentions.

JAMES BEGGS & CO.

9 Dey street, New York.

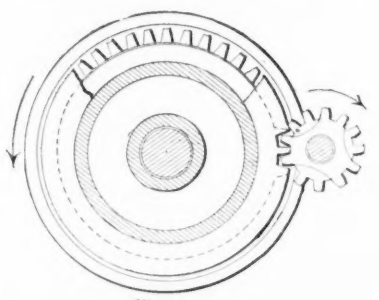
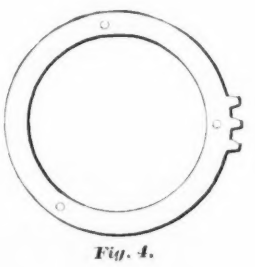


Fig. 3.



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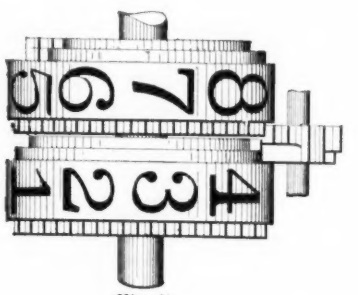

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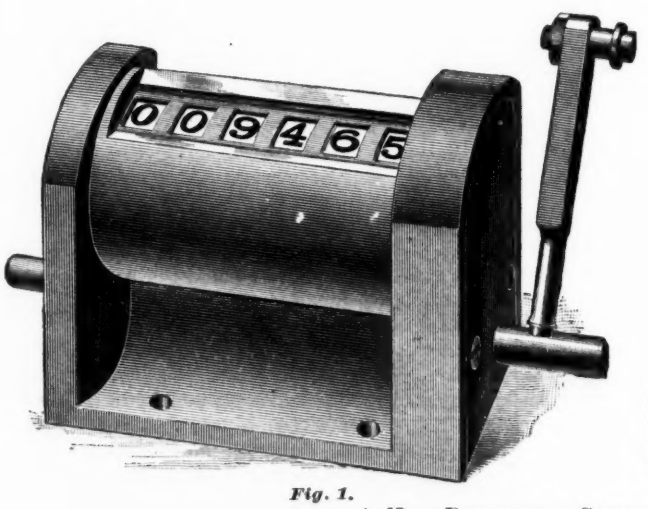

Fig. 1.

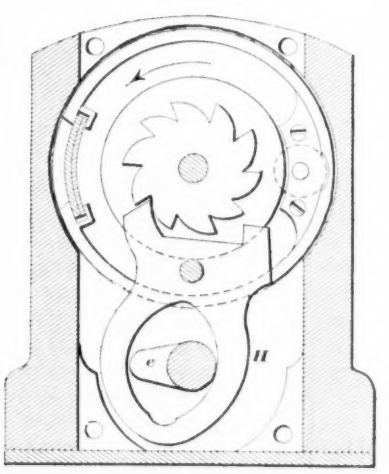

Fig. 2.

A NEW REVOLUTION COUNTER.

A New Revolution Counter.

We present with this, engravings showing the general appearance and construction of a new revolution counter which has some novel features, among these the ability to count revolutions at much higher speeds than usual.

The counting wheels are placed loosely upon a shaft which passes from end to end through the counter, these wheels and the pinions by which they are moved being inclosed within a cylinder which can be turned to any one of three different positions in the frame, so that the reading point may be on top, as shown in the perspective cut, or it may be at either side, as is most convenient, and the change from one to the other is made by simply removing and inserting one screw.

Fig. 2 gives a sectional view of the counter, showing the lever and pawl by which the first wheel is moved. The short lever *e* is upon a shaft (shown in section) which passes through and projects at both sides of the machine, so that it may be connected and operated at either side. The lever *e* works within the opening in the pawl *H*, which is so formed that it moves the ratchet wheel one tooth at each oscillation and prevents it from being moved more than one tooth, so that this movement is positive. And it makes no difference whether the shaft and lever *e* be rotated continuously, or given an oscillating motion with the lever above or below the shaft, the counting goes on the same; one revolution or one oscillation advancing the first wheel one figure. Motion is transmitted from this first wheel to the second by means of the small pinion seen at the right of Figs. 3 and 5. This pinion, though made of a single piece of steel, is in reality in two parts, one of which is an interrupted pinion which is arranged to be turned one-third of a revolution by the engagement of the three teeth seen on the wheel, Fig. 4, which is riveted to the left of each counting wheel. During the rest of the revolution of the wheel, Fig. 4, the pinion is held still by the blank portion of the wheel entering one of the three openings in the pinion, this being an application of the principle of the Geneva stop motion. One-third of a revolution of the pinion moves the next counting wheel one tenth of a revolution.

All the wheels are alike, and are connected by pinions which are alike, the result being that each succeeding wheel is turned one-tenth of a revolution by a complete revolution of the wheel to the right of it. With six wheels 1,000,000 are counted, and the figures are placed close together, making it easy to read and difficult to tamper with. The lever *e*, the pawl *H*, the ratchet wheel, and all the gears and pinions are made of steel, the pawl ratchet and lever hardened, so that it may be expected to be durable and reliable in action.

As to capacity to count at comparatively high speeds, it is only necessary to say that a representative of this journal timed one of them which was run by holding the shaft in a drill chuck and driving it in a speed lathe. It counted at the rate of 2,000 revolutions per minute, and ran continuously, without apparent effort, at 1,500 revolutions. It is made in two sizes, and, where desired, is furnished with a set back attachment, which, by the movement of a lever, sets all the wheels at zero. The manufacturers are The Davids Machine Works, 129 Worth street, New York City.

World's Columbian Exposition.

Contracts have recently been closed for five of the six 72" belts which will be used to drive the six belt-driven Westinghouse 10,000 incandescent light dynamos. They are all loaned to the Exposition Company by their manufacturers, free of cost.

A unique feature of the power plant will be the driving of two of the large Westinghouse dynamos in tandem from the thirty-feet fly-wheel of the 2,000 h. p. Allis engine. Both belts are 72" wide; the under one is about 149 feet long and the upper one 186 feet. These two belts and the one from the Fraser & Chalmer 1,000 h. p. engine are furnished by the Page Belting Co. W. D. Allen & Co. furnish the belt on the 1,000 h. p. Buckeye, and Schieren & Co. that on the McIntosh & Seymour engine.

Work is being pushed night and day on the foundations for engines, and it is hoped that those for engines in the lighting plant will be completed by the first week in December. It is also expected that the boilers will be almost completely erected by that time.

The main power headers are being put in place. These headers are seven in number, are 36 inches in diameter, and constructed of $\frac{5}{16}$-inch boiler steel. They have an aggregate length of 750 feet, extending the entire length of the boiler house and boiler house annex. The adjacent sections are connected by 10" equalizing pipes, which are arranged to take up the expansion.

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Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.

We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.

We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.

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The Danforth Case.

Last week we said that we should have something more to say regarding the decision of the Secretary of the Navy in the case of engineer Danforth, who was punished for declining to leave the engine room at a time when he was in charge of it, in answer to a message from the officer of the deck. But, after all, we do not know that there is much more to say in addition to what has been said, and ex engineers who have had experience in the navy say that our remarks of last week hit the nail on the head, and really indicate the source of all the difficulty.

It is morally certain, however, that sooner or later there will be serious trouble from the fact that any young ensign who may happen to be officer of the deck, and anxious to display the "little brief authority" with which he is clothed as the representative of the captain, may at any time, and regardless of consequences, send for any man in the engineer department of a vessel, and have him removed from a station assigned to him by the engineer in charge without the knowledge of that engineer, and may even demand that the engineer himself shall appear on deck at once in response to his order, regardless of his duties in the engine room. Naval surgeons are also subject to the annoyance of petty authority and red tape, and some are reported as inquiring if this decision in the Danforth case does not mean that, if they should happen to be in the midst of an important surgical operation when an order reached them to appear on deck, they should immediately drop their instruments and go, and perhaps allow the patient to bleed to death. That is really what the decision does seem to mean, though, of course, there can be no doubt what any surgeon worthy of the name would do under such circumstances; while unfortunately there can be little doubt but that there are officers in the navy who would insist upon his being punished for refusing to leave his work at such a time.

In spite of all naval rules and customs to the contrary, we say that the officer of the deck who ordered the removal of the machinist Dunlop from the engine room while on duty, without notifying the engineer on watch, was entirely wrong by every principle of courtesy and ethics, and that his ordering the engineer officer who was on duty to appear before him on deck, regardless of the fact that speaking tubes, and every other needed means of communication with him, were at hand, was so certainly wrong as to almost place it beyond the pale of discussion by reasonable men, especially those who know anything of the duties of an engineer. We also hope and believe that this matter will not rest here nor anywhere short of a ruling, or, if need be, a law of Congress, which shall compel a recognition of the fact that men cannot be reasonably held responsible for that which they cannot control, and that engineer officers of the navy, who are held responsible for the steam plant, should have authority over it, at least so far as necessary to its successful working, without interference.

Secretary Tracy by his decision, and by his taking pains to say that, were it not for the youth of Danforth, he would have directed even a more severe sentence against him, has shown simply that he has been dominated entirely by the influence of the line officers by whom he is surrounded. No such decision could possibly have been rendered by a man who had allowed himself to look upon the other side of the matter. It is a shame and a disgrace that in this country, which pretends to have a special regard for the mechanic, and in its navy, which owes so much of its glory to engineers, such an utterly unreasonable and unjust performance as this should be possible.

Soldering and Polishing Aluminum.

Following the publication in our columns of the abstract of Mr. Alfred E. Hunt's paper on aluminum (issue of Nov. 3), we received numerous inquiries for particulars regarding the methods of soldering and polishing referred to in the paper. An item has been going the rounds of the press to the effect that chloride of silver sprinkled on the surfaces to be soldered, and melted down, enables aluminum to be readily soldered. We wrote to Mr. Hunt, asking him if he had experience with this, and also for particulars regarding the solder to which he referred in his paper. In his reply he says:

"Regarding solder, the one about which you ask is the Page-Anderson solder, of Waterbury, Conn. Wm. H. Pierce, attorney, Waterbury, Conn., represents them. Chloride of silver does aid in the flow of the solder, does give a stout joint, but does not work as satisfactorily as we could wish, and is an expensive salt to use. We have a different solder, and we think a better one, and a better method of using it. This we are now trying to obtain a patent for, and therefore you can understand that it would not be wise for us to write you about it just now. As soon as we are able to do so, I will gladly give you what information I can."

We then wrote to Mr. Pierce, and received from him the following reply:

"In the matter of the Page-Anderson process of soldering aluminum, about which you inquire, I can say that a U. S. and 12 foreign patents were taken out, but that up to the present time the process has not proven satisfactory, entirely, on account of the fact that its operation is not even; sometimes the results are good, all right, and then again the flux eats the metal, and the seam does not hold. Inventors still experimenting to overcome this. I doubt if the metal is ever successfully soldered."

In regard to polishing aluminum, Mr. Hunt informs us that the material referred to is known as "Almeta," and that it may be obtained of Hunt & Clapp, No. 95 Fifth avenue, Pittsburgh, Pa. This, no doubt, will seem like a good deal of a free advertisement, but it replies to so many inquiries from our readers that we know we are doing them a service by its publication.

Nickel Steel in Machinery.

The success which has attended the use of "nickel steel" for armor plates has led Commodore Melville to consider the practicability of using it for parts of the engines and boilers of naval vessels. Its tensile strength of 90,000 pounds per square inch, as compared with 60,000 to 65,000 pounds for ordinary steel, and with an elongation practically the same, would make it seem as though the use of such a steel ought to give very great advantages where it is important to get the highest possible power out of the lightest possible machinery. For a boiler shell, for instance, which, with the ordinary carbon steel, must be 1½" thick, if made of nickel steel it may be 1" thick, and yet have equal strength, thus securing a very important reduction in weight. For propeller shafts, too, it ought to permit a considerable reduction in weight, and we understand that it is for this purpose that it is to be tried as part of the motive machinery of a naval vessel, Commodore Melville having ordered sections of shafts made of it for use in two of the new vessels. If these prove satisfactory, as it is believed they will, then it is probable that it will be tried in the construction of engines and boilers, and may lead to important results in this and other kinds of machinery.

A case in which competition seems to be working well in the interest of the public is seen in the contest between the Pennsylvania Railroad and the Bound Brook, or "Royal Blue Line," for passenger traffic between New York and Washington. Each road seems to be doing its level best to reduce the time, the last reduction by the "Blue Line" to five hours having caused the Pennsylvania to improve its track in various ways, and prepare to do it in less, the intention being, it is reported, to make the run in four and a half hours. The run from New York to Philadelphia, 90 miles, will be made in 90 minutes, and the distance from there to Washington at the rate of 50 miles an hour. In this connection it may be interesting to note that when the "Blue Line" fast train was put on, some men prominent in the mechanical department of the line, and who probably knew all about it, declared that it would be entirely practicable to reduce the time between Philadelphia and Washington by 25 minutes. Another good result of the competition is that there is now "no extra fare charged for fast time" on either road.

General surprise is manifested at the decision of the trunk line presidents to charge full fare for passengers from New York during the World's Fair, on all except what are now the phenomenally slow trains, but, at the same time, it is pretty well understood that the rates fixed at the recent meeting are very likely to be slashed all to pieces before the summer is over, and it is our opinion that none of our foreign friends, nor those living in this part of the country, need to give up their preparations to visit the Fair on account of the threatened high railroad fares.

We have had a large number of inquiries as to the standing of the "Correspondence School of Mechanics," of Scranton, Pa. We cannot vouch for the character of this school from personal observation, but we did believe, and still believe, that it is a genuine, squarely-conducted institution. This belief comes from considerable inquiry on our part, and from the eminent names of men who are apparently willing that their names be used in a way to help the institution. More than this we cannot say.

Mr. Julius Kraus, who was formerly with the Niles Tool Works at Hamilton, but for a few years past has been in charge of the planer work at the Cooke Locomotive Works, Paterson, has returned to the Niles Works and is in charge of what is known as the "East shop" there.

The sixty-fourth meeting of the American Institute of Mining Engineers will be held in Montreal, Canada, beginning on Tuesday evening, February 21.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(529) J. K., Gladstone, Mich., writes: Please give me the process for bluing gun barrels and other parts of guns. *A.*—This process is described by B. F. Spalding, in our issue of October 2, 1890.

(530) J. A. B., Berlin Falls, N. H., writes: Kindly inform me if the Correspondence School of Mechanics is a good thing, and is it reliable? *A.*—Investigations previously made by us lead us to believe that this is a good and reliable institution.

(531) E W., Toronto, Can., asks: Can a broken piece of cast-iron be brazed and made strong again, and if so, how is it done? *A.*—It is doubtful if it can be made as strong as it was originally, but it may be brazed much the same as other brazing is done, by using "spelter solder," cleaning the surfaces and heating while bound together.

(532) P. R. M., New Orleans, La., writes: Be kind enough to state just what is meant by squaring a circle. *A.*—By squaring a circle is meant to find the side of a square whose area is equal to that of the circle, but since it is impossible to compute the area of a circle exactly, it is also impossible to find the side of a corresponding square.

(533) B. F. S., San Francisco, Cal., writes: Please inform me through the columns of your paper, what is the best composition for removing scale from a boiler, *A.*—Kerosine oil has been used with excellent results. 2. Which is the best cylinder oil to use where the oil from the exhaust goes into the feed water and is then forced into the boiler?

A.—Only mineral oils should be used for lubricating the cylinders; there are special brands prepared for this purpose.

(534) M. J. K., Troy, N. Y., writes: My brother is making some copper castings for electrical purposes, and he finds it difficult to make them sound; that is, there are little pinholes, or air-holes in them when finished in the lathe. How can the difficulty be overcome? *A.*—Pure copper will not cast without honeycombing. If the molds are made in green sand, add 1½ pounds of zinc, used as a flux, to every 100 pounds of copper. This will cause the trouble to cease.

(535) L. W., Scottdale, Pa., writes: I notice that in keying a crank disk of a steam engine to the shaft some builders drive the key through the counterbalance, while other builders cut the keyway through the crank. Please inform us which is the best way of keying the disk to the shaft, and thereby settle a dispute. *A.*—Keyways will always weaken the disk more or less, and since that part of it which acts as a counterbalance is the strongest part, we prefer to cut the keyway through the counterbalance.

(536) L. M., Detroit, Mich., writes: In your issue of November 10, Question 476, T. C. wants to know where he can get a working model of a locomotive. I have one, and if you will give me the address of the person purchasing or wanting to purchase one, you will oblige *A.*—All questions sent to us are considered as confidential matter, and therefore we cannot give the address of the correspondent. Should you wish to enter into correspondence with any one, send your letter to us, and we shall take pleasure in forwarding it; this will give the person addressed the option of revealing his identity.

(537) A. M., Louisville, Ky., writes: Please give me through your valuable paper some information as to the modern methods of molding life-size statues in bronze. In what position is the statue when the bronze is being poured into the mold? and how are the cores supported and kept in position in the mold? Can you describe the process of molding and casting the statue of Henry Ward Beecher, which was cast in New York? *A.*—The business is a very exclusive one What has been published on this subject is very meager and uncertain, and therefore apt to be misleading. We expect to publish a paper on this subject before long.

(538) D. K. E, Plainfield, N. J., writes: I wish you would inform me through your paper whether there is any place in New York City where a person can learn the machinist trade by working nights. *A.*—We do not know of such a place. The best way to learn the trade is to work in a regular machine shop under instructions or as an apprentice. We should prefer a machine shop in which considerable jobbing work is done. 2. Also please inform me if there are any books written which treat on printing presses. *A.*—F. J. F. Wilson has published two works on printing machinery. They are English works, and can be obtained from any dealer in scientific publications.

(539) F. H. M., Brooklyn, N. Y., writes: Kindly inform me how paper car wheels compare with cast-iron ones in regard to tensile and compressive strength. *A.*—For all practical purposes it may be assumed that there is no difference in the tensile and compressive strength of paper wheels and cast-iron ones. 2. Can they be worked, that is, planed, drilled, and turned, as metals are? *A.*—You seem to have a wrong impression of the construction of paper wheels. There is nothing but metal exposed which needs to be turned, drilled, etc. 3. Is their conductivity of heat known? *A.*—Not that we are aware of. 4. Is there any literature on the subject? *A.*—We have seen none. 5. How could I obtain some of the material to experiment on? *A.*—You may probably get some by writing to the manufacturers, Allen Paper Car Wheel Co., Chicago, Ill.

(540) W. F., Warren, Pa., writes: Kindly inform us if there is any mixture of sand, or any preparation with which to coat dry sand cores to keep them from getting damp after being placed in the mold? We have to use a great number of small cores, and cast but two or three times a week, and we find if we leave the cores in the mold over twenty-four hours that they get damp and blow. *A.*—Use the following core sand mixture: Mix thoroughly, when dry, half and half river sand and fire sand, sift through a fine sieve; then to 15 parts of mixed sands add 1 part of resin, ½ part of flour, and mix with weak molasses water. This mixture is taken from "The Iron Founder," by Simpson Bolland, an excellent book to refer to for all kinds of foundry matters. To the foregoing mixture may be added 1 part of sawdust to ten parts of mixed sands. This addition will be required only when the cores must lay in the molds several days.

(541) H. A., ——, N. J., writes: I wish you would settle a dispute relating to the following subject: We have two boilers standing parallel to each other; we have also two steam engines placed at one side of the boilers, say at the left side. The boilers are connected by a 5-inch pipe because the steam pipe of each engine is 5 inches in diameter. A horizontal pipe 7 inches diameter leads from the left-hand side boiler to the engine placed furthest from this boiler, and from this pipe a vertical 5 inch pipe leads to each engine. Now please inform us of the use of keeping the horizontal pipe 7 inches in diameter after it has passed the first engine. Would not a pipe 5 inches in diameter give as good results? *A.*—Theoretically the 7 inch pipe could be reduced to 5 inches after it has passed the first engine, and even from a practical standpoint a 5-inch pipe from one engine to the other will give the same results as the 7-inch one, provided there is plenty of steam space in the boilers; but if this steam space is comparatively small we should prefer the 7-inch pipe to continue to the last engine, so as to reduce the velocity of the steam in this pipe, and avoid as much as possible the raising of water out of the boilers. We should also prefer to connect the two boilers by a 7-inch pipe, so that in case of repairs both engines could be run from one boiler.

(542) Western ——, writes: The plant I am running consists of one 12x22x24-inch compound engine, and a number of smaller, simple auxiliary engines. The main engine is of the jet condensing type, with air-pump and feed-pump attached to it. The firm is talking of putting in an independent condenser and turning all the exhaust but that from the main engine into it. Considering that the main engine will give a sufficient amount of feed water, would it not be economical to put in an open heater and an economizer? We have two marine boilers connected into one stack. The temperature of the water due to condensation ranges from 110 to 125 degrees. It carries a great deal of lime and vegetable matter. So far, I have had no experience with either economizer or open heater, but I believe they will save fuel, and they will not require much attention. *A.*—The heater will save a small amount of fuel, but this saving may be offset by the extra cost of attendance due to the additional appliances. Whether there will be a gain in using an economizer will depend on the temperature of the gases entering into the chimney. Your data is very meager, but from what you have given we are inclined to believe that the plant is very well arranged, and it is doubtful whether the gain obtained by the use of heater and economizer will pay for the expense in putting them in, and the extra attendance incurred. 2. Would the pump work when the water at the suction has a temperature of 180 degrees? *A.*—Yes, provided the pump is placed low enough so that water can flow into it.

(543) W. S. H., Morgantown, W. Va., asks: What is the horse-power of an 18-inch double belt running under the following conditions: Diameter of driving pulley, 7 feet; diameter of driven pulley, 3 feet; speed of driving pulley, 158 revolutions per minute; distance between centers, 17 feet 9 inches. The driven pulley is made of wood. Please give rule for computing the horse-power of belts. *A.*—The belt should transmit under the given conditions 142 horse-power. The following formula for computing the horse-power which a double belt will transmit may be used:

$$H = \frac{D \times R \times W}{1{,}925},$$

in which H denotes the horse power; D the diameter of the pulley in inches; R the revolutions per minute, and W the width of belt in inches. This rule will not apply in all cases; circumstances and conditions will modify it. For belts, however, running under favorable conditions, the foregoing rule may be regarded as safe and reliable. Of course the above applies to open belts and the pulleys over which the belt runs, equal in diameter, or nearly so, making the arcs of contact nearly equal to the semi-circumference, as we find them to be in the given example. When the diameters of pulleys and position is such as to reduce arc of contact very much then determine the arc of contact of the small pulley. When this arc is ¼ of the circumference divide the horse-power, as obtained by the foregoing rule, by 2.21, and for other arcs of contact use the following divisors: For $\frac{5}{16}$ of the circumference, 1.72; for ⅜, 1.6; for ⅞, 1.4; for $\frac{15}{16}$, 1.24; for $\frac{7}{16}$, 1.17. 2. The wooden pulley keeps up a constant humming noise and makes the house tremble. Is there any way to remedy this? *A.*—The pulley is probably out of balance; if so the remedy is evident. 3. I am building a small engine, 1½x3 inches, speed 300 revolutions per minute. What should be the size of the steam ports, exhaust port, inside and outside lap of valve and travel of valve? *A.*—In small engines of this kind the smallest steam ports that can be cast, so as to insure a good casting, are generally large enough. We should make the steam ports ⅛ inch long, ⅛ inch wide, exhaust ports ¼x¼ inch; outside lap, ⅛ inch; inside lap, just sufficient to insure the steam ports being covered when the valve is in the central position; travel of valve, $\frac{5}{16}$ inch. 4. How much oil should I use in a 14x20-inch cylinder during a run of 15 hours, the engine making about 158 revolutions per minute? *A.*—From one-half to one pint. 5. I inclose a circular of an indicator. Is this instrument reliable and will it do all that is claimed for it by the manufacturers? This question is, of course, strictly confidential. *A.*—We never give preference, either privately or through our columns, to any make of indicator, machine or device.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Philadelphians please note, Grant, page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

$10 Countershafts. A. D Pentz, Elizabeth, N. J.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

New lists of cutters. Brown & Sharpe.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co, Syracuse, N. Y

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

S. A. Smith, 23 S. Canal St., Chicago, Ill., is agent for Standard Tool Co.'s Twist Drills.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Castings for small and medium-sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio

Clayton Air Compressor Works, 43 Dey St., N. Y. Compressors for experim'ts to 300 lbs. pressure, $50.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt, Newark, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th St., N. Y. Send for des'n.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., cor. Canal and Washington Sts., Chicago, Ill.

Patterson, Gottfried & Hunter, Limited, 146-150 Centre st., New York, are putting on the market a new alarm speed indicator. Send for circulars.

We electrotype illustrations and advertisements for manufacturers. Prompt and thorough service. Send for estimates. A. Mugford, Hartford, Conn

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Meeting of the A. S. M. E.

(*Concluded from page 5.*)

from the Auditorium Building in Chicago, called the Art Memorial Building. This building, in respect of auditorium rooms and other features, was admirably adapted to the purpose, and the first session would include all sections meeting together, at 10 A. M., July 31, 1893. The last session, Aug. 5, would also include all sections, the various sections being left to arrange for their separate meetings in the same building between these dates. The papers read and subjects discussed by the various sections would be left to those sections, and each would publish its proceedings in the usual way, with such other matter pertaining to the Congress as it might see fit. The entire proceedings of the Congress would be published by the World's Fair Commission, and the books sold at cost of publication.

A building for an engineering headquarters had also been secured. It is situated near the auditorium building and the most direct lines of transportation to the Exposition grounds, and will be made use of for committee work, minor meetings and receptions, and any other purposes calculated to advance the interests or enhance the comfort and enjoyment of engineers of all lands. Men are to be always here who could converse with visitors in any language.

A communication was presented from the Piqua Rolling Mill Co., which referred to the old and ever-exasperating matter of the confusion existing in wire and sheet metal gauges. This firm proposed a new gauge, and stated that efforts were in contemplation for securing its indorsement by Congress as the U. S. Standard. Printed tables showing the proposed gauge sizes were distributed, and showed many of the familiar features existing in gauges now used; *i. e.*, the first number on the list is 0000000, though in this case this was the largest wire and thickest sheet, (.5",) instead of the smallest. The reason for going so far below unity for the first number on the list, which led to its adoption in the old gauge, being entirely wanting in this, and no reason whatever being discoverable for it.

Though this gauge and table were strongly objected to by some of the members who are much devoted to what they are pleased to term the natural method of division, as opposed to the decimal, it would seem as though it ought to meet their views in part, the variations in sizes between the different numbers varying, first by $\frac{1}{32}$", then as the sizes grow smaller by $\frac{1}{64}$" and $\frac{1}{128}$". At this point a strange departure from this method of bisection takes place, and sizes vary by $\frac{1}{180}$", $\frac{1}{320}$", $\frac{1}{640}$", $\frac{1}{1280}$", and finally by $\frac{1}{2560}$", some of the decimal fractions resulting from this being .0703125", .0109375", .00859375, and .006640625". The general opinion seemed to be that this scheme of a gauge, if pushed, might possibly result in introducing it sufficiently to further increase the already existing confusion on the subject, but could by no possibility result in the least benefit in any way. After some discussion the president was authorized to appoint a committee to investigate the matter of gauges and report upon it at a future meeting.

At the conclusion of this discussion the presentation and discussion of professional papers was taken up, the first paper presented being that of Mr. F. H. Daniels, on an Interesting Boiler Explosion. This paper excited so much interest and caused so much discussion that, although three other papers were to be presented, the time was all taken up by this one. Indeed, the discussion took such a wide field, and so many causes were brought forward for such an explosion, that a prominent member, interested in boilers, of course, but more interested in fine tool work and large telescopes, remarked to the writer that he believed he should go home and throw out the boiler from his shop and turn the engine by hand. The substance of this discussion we shall publish with the paper soon.

Wednesday afternoon was left free, and many of the members spent it at the house in social intercourse, to which, as previously announced, the evening was given up, a reception being given at "Sherry's," 37th street and Fifth ave., which was largely attended and evidently very much enjoyed, many of the California excursionists of last spring meeting here for the first time since the breaking up of the party at San Francisco.

At the close of Thursday morning's session a pleasant incident occurred in the impromptu reception tendered to one of the first members of the society, Mr. Thos. F. Rowland, who for various reasons had been unable to attend a meeting for some years. Mr. Holloway introduced Mr. Rowland in very complimentary terms, referring to his services as the builder of the "Monitor," and the members rose to their feet as Mr. Rowland was escorted to the platform by Prof. Thurston, who saw service in the navy as an

engineer during the war; and at the platform they were received by President Loring, who had a good deal of the same experience. Mr. Rowland was urged to give some reminiscences of the building of the "Monitor," but declined, saying there was nothing of interest to add to what had already been told, and finally knocking about all the sentiment out of the occasion by declaring that the simple fact was that he did not believe the men who devised and built the "Monitor" were entitled to quite so much honor as had been heaped upon them; that their chief incentive in doing the work was the perfectly human one—money—and this motive was probably much stronger than patriotism or any other. During the lunch which followed, Mr. Rowland was observed in conversation with some of his contemporaries on subjects that would, no doubt, have been very interesting to the members generally, if he could have been induced to address them.

A considerable number of the members went on an excursion to the Pond Tool Works at Plainfield in the afternoon, where they had an opportunity to see an exceptionally fine machine tool shop and to observe the work going on, on the gun lathes for Watervliet arsenal.

At Thursday evening's session, the paper that excited most discussion was Mr. Porter's formal discussion of the topical question, "Shall there be an overhauling of the right to use the title Engineer?" Incidentally this afforded another opportunity for those who are ever ready to discuss the question of the importance and necessity for technical education in the practice of engineering, and it was made full use of, some of the members (graduates) evidently being imbued with the idea that, if not in the past, then soon in the future, no man could hope to know much of mechanical engineering, or be successful in its practice, unless a graduate of some school of engineering, while others (not graduates) evidently just as firmly believed that a course in such a school was rather a detriment, and, to say the least, not essential; members on each side presenting cases which they seemed to think proved their respective positions.

At Friday morning's session, the presentation of Prof. Peabody's paper on a "Test on the triple-expansion engine at the Massachusetts Institute of Technology," which had been deferred at his request from the first session, gave the usual opportunity to the various professors of the engineering schools to show how the methods pursued at other schools than their own were deficient, but the discussion was nevertheless interesting, and we shall probably have more to say of it and of that on other papers in future issues.

Native African Iron Masters.

The Balubans, as the natives of the Muansanyomma district of Central Africa are styled, enjoy an excellent local reputation as iron workers. They find their crude materials in the form of bog iron ore on the surface of the land. It rarely happens that digging to an appreciable depth is necessary. Their smelting furnaces, which are constructed of clay, are from six to ten feet high, from forty to sixty inches in diameter at the base, and conical in shape. The ore is tipped into the furnace from above; the charcoal, on the other hand, is introduced into basin-like side openings, which also receive a continuous air blast, while the iron and slag are removed from the bottom of the furnace about every eight or twelve hours, according to the degree of heat obtained.

The forge is a circular building some sixteen feet in diameter, with a pointed roof and open sides. At a distance it might be taken for a park band-stand. In the center of this hut is the fire, which is maintained in constant activity by means of a unique pair of bellows, which merit a special description. They consist of a block of wood, generally twenty inches long, hollowed out and fitted with a funnel head made of clay. At the lower end are two orifices, over which skins are stretched. Motion is imparted to the instrument by the action of two small rods. The hammer is of solid iron; the tongs are marvels of simplicity—namely, a bent palm branch. An iron wedge driven into a timber bole serves as an anvil.

The recollections of the Balubans carry them back to the time when they wrought metals with stone tools. Some of the natives are comparatively artistic workers. Very fine axes, tastefully inlaid with copper, are produced. Strikes among these swarthy artificers, it should be noted, are of comparatively rare occurrence, probably owing to the fact that the malcontents invariably have their heads lopped off and their skins placed on one side for patching, or, in case of need, entirely re-covering the aforesaid curious bellows.—*Iron* (London).

MANUFACTURES

Pleasantville, N. J., is to have a new shoe factory.

The Reading (Pa.) Iron Co. will erect an enlarged building.

The Addyston Pipe and Steel Co., Newport, Ky., has started.

The Long Island Cotton-mills Co., Monbo, N. C., may enlarge.

Brewer, Me., will have a plant for the manufacturing of stilts.

The Mammoth Springs (Ark.) Cotton-mill is adding machinery.

A new woolen-mill is to be established at West Chester, Penn.

The Whitman Agricultural Works, Auburn, Me., are to be enlarged.

Ellis & Wise are building a mill on Wilson Stream, Williamantic, Me.

E. P. Shaw is planning to equip an electric plant in Merrimac, Mass.

The Bellaire (O.) Nail Works may erect another furnace at its plant.

The Vulcan Iron Works at South Chester, Penn., have been organized.

Parties are to build a woolen-mill, to cost $25,000, at Carrollton, Ky.

The Maryland Steel Co., Sparrow's Point, is erecting a boiler shop.

Lumber has arrived at New Bedford, Mass., for the new Hathaway mill.

The Beaver Dam (Wis.) Malleable Iron Works has been recently organized.

The Cleveland (O.) Steel Casting Co. has been organized; capital, $100.000.

The Columbian Box Company, of Brownville, N. Y., has been incorporated.

Warren & Terry will erect a mill for seamless hosiery, at Appanaugh, R. I.

L. S. Johnson & Co. are having a new factory built for them in Lynn, Mass.

The Leland Tanning Company, Skowhegan, Me., is ready to resume operations.

The Tuckaseege Manufacturing Company, Mt. Holly, N. C., may add machinery.

Schott & Seymour have established a mill in Pine Meadow, Conn., to make hosiery.

The Warden Manufacturing Co., Philadelphia, Pa., will erect an iron boiler shop.

Saugatuck Iron Foundry, New York City, has been organized, with capital $30,000.

C. A. Adams, a paper box manufacturer, proposes to erect a factory in Skowhegan, Me.

At Brooks, Me., $14,000 has been subscribed toward the erection of a shoe factory.

Allen & Ryan are building a new mill at Providence, R. I., to operate about 30 looms.

J. N. Van Antwerp is making improvements at his knitting mills at Amsterdam, N. Y.

A steam and dye plant has been established by Copleston & Ortman at Columbia, S. C.

It is said that G. McArthur and others propose establishing a linen-mill at Appleton, Wis.

Gardiner & Warring are constructing an addition to their knitting-mill at Amsterdam, N. Y.

It is reported that the stove foundry of Noyes & Goddard at Waterville, Me., will be rebuilt.

At the Hope village, R. I., the Hope Manufacturing Co. is making extensive improvements.

The Allegan Paper Company has been incorporated at Kalamazoo, Mich. Capital, $25,000.

The Shawmut Fuse Wire Co. has been incorporated at Portland, Me., with $25,000 capital.

The axe and edge tool manufactory at Bloodville, near Ballston Spa, N. Y., will be rebuilt.

The Danville (Ill.) Hominy and Milling Company has been incorporated. Capital stock, $35,000.

Winship & Bolt are making alterations at their hosiery and underwear-mill at Wakefield, Mass.

The Chester Steel Casting Company, Philadelphia, Pa., is to establish an enlargement to its foundry.

The Coogan & Pasey Co., of Windsor Locks, Conn., has been organized, to manufacture paper.

Capitalists will subscribe for a new shoe factory at Hanover, Penn., to manufacture men's and boys' shoes.

The Norton Clasp Shoe Company has been incorporated, at Portland, Me., with $100,000 capital stock.

The planing-mill of the Donald Lumber Co., of Mobile, Ala., which was burned recently, will be rebuilt.

The Fulton Iron Works of the San Francisco peninsula are to be incorporated, with $1,000,000 capital.

The Minneapolis Lace Paper and Mosaic Co. has been organized at Minneapolis, Minn. The capital is $50,000.

It is reported that a plant will be erected in Kokomo, Ind., for the manufacture of hardware novelties.

Hearne (Texas) Compress Co. has been incorporated, with a capital stock of $90,000, to operate a compress.

The Electric Power and Heating Company, with a capital of $500,000 has been incorporated in Peoria, Ill.

F. A. Parker & Co., of Marblehead, Mass., are making additions to their factory, putting in new boiler, etc.

At Titusville, Penn., parties have subscribed $5,700 to aid the establishment of a new wood-working enterprise.

The Imperial Manufacturing Company has been organized at New York, to manufacture shirts and underwear.

The Pickard Hosiery Company is increasing its plant by adding new machinery to its plant at Westbrook, Me.

A new brick manufacturing concern for paving brick is to be established at Galesburg, Ill., with a lay-out of $400,000.

W. W. & R. M. Keyes Co. has recently established business as manufacturers of babbitt metal in Bridgeport, Conn.

At Gloucester, Mass., it is said the recently organized Charles River Rubber Company will establish its plant here.

C. A. Miles, of Epping, N. H., is to erect a new shoe factory; the same is to be leased to M. G. Nichols for five years.

The Quanah (Texas) Mill and Elevator Co., to operate a flour-mill, has been incorporated, with a capital stock of $50,000.

The Powhatan Manufacturing Company has been incorporated, to manufacture knit goods, at Newark, N. J. Capital, $40,000.

The Automatic Machine Company, recently organized at New Orleans, La., is now manufacturing. The capital stock is $300,000.

There is a report that Taunton, Mass., may have another cotton-yarn-mill, the Nemasket mill having proved to be a profitable enterprise.

Work on the new addition to the shoe factory of Isaac Prouty & Co., Spencer, Mass., is progressing. The building will be 42x120, six stories.

Henry S. Libhart, miller, near Hellam station, York, Pa., is erecting a large and extensive new saw-mill in connection with his grist-mill.

The Newport (Ky.) Rolling-mill Company has added to the plant two plate-mills, and it is intended to erect three sheet mills next season.

The Portsmouth Machine Co., of Portsmouth, N. H., is making an addition to its iron foundry, 60x60, which will about double its present capacity.

The A. S. Helmes Refining Company, of Buffalo, N. Y., has been organized, to manufacture petroleum oils and their products. Capital, $300,000.

At Lowell, Mass., the New England Worsted Company, which purchased recently the property of the Dugdale Mills, will start at once enlarging.

The Ivoroyd Manufacturing Co. has been organized at Paterson, N. J., to manufacture mirrors and other articles from ivoroyd. The capital is $100,000.

The Boston Rubber Shoe Co. has been granted permission to erect a four story brick building on Commercial street, Boston, Mass., to cost $100,000.

The addition to the plant of the Whitinsville (Mass.) Spinning Company will increase the facilities 50 per cent. The new machinery is ready for use.

G. Leland Johnson and Rollin Doubleday, Dana, Mass., have formed a partnership under the name of Johnson & Doubleday, for the manufacturing of wooden boxes.

Sheehy & McCarthy, a new shoe manufacturing firm, will occupy a factory, to be erected on the site of the Brockton Last Co.'s burned building, at Brockton, Mass.

Parties have organized a stock company known as the Ridge Creek Woolen-mill Company, at Silvicola, Tenn., and are now engaged in the erection of a woolen-mill.

At Fairhaven, Mass., a building is to be erected, to be used by Lewis S. Judd for the foundry business. It is to be 120 by 65 feet in area, with 20 feet posts, and a flat roof.

Smyser's mill along the Wrightsville road, at York, Pa., owned by Fahs, Smyser & Co., is being remodeled, and a number of improvements made, which will greatly improve it.

Mr. Myron Woodbury, boot and shoe manufacturer, of Beverly, Mass., is erecting an addition to his factory 60x30, four stories high, and will add considerable new machinery.

There is to be an extract factory erected at Niagara Falls, N. Y. The parties interested come from Toronto and New York, in both of which places it is said they have branches.

J. T. Slocomb & Co., Providence, R. I., issue a little circular setting forth the merits of the inside micrometer caliper and combination center drills and reamer which they make for the market.

The North End Street Railway Company, of Worcester, Mass., has petitioned the railroad commissioners for permission to increase its capital stock $50,000, in order to build and equip its lines.

The stockholders of the Consolidated Electric Storage Company, of New York, have filed a certificate announcing that the capital stock of the company has been increased from $1,000,000 to $3,000,000.

A rolling-mill is projected at Decatur, Ill., to give employment to 400 men, and to cost $150,000. Committees have been appointed to raise subscriptions and make other negotiations for the securing of the plant.

A cotton-seed oil mill and soap factory has been established at San Pedro, State of Coahuila, Mexico. The present output is stated to be 120,000 pounds weekly of common and toilet soap. The cotton-seed used is from the Laguna district.

Verlenden Bros., of the Imperial Mills of Darby, Pa., are excavating for a two-story addition to their "picker house," 28x40 feet. They also propose building immediately a ninety-foot extension to their mill, three stories high and 200 feet long. This will be known as No. 2 Mill.

A. J. Weed & Co., 106 Liberty street, New York, are furnishing castings, at a small cost, for model dynamos. We presume the dynamo is intended more for experimental purposes, and to give an idea of the principles involved, than for actual work, but no doubt it will do actual work, if required.

A short time since we illustrated the Bowsher balancing machine made by N. P. Bowsher, South Bend, Ind. We have recently heard from the manufacturer that there are many orders for their machines, and we are furnished with a long list of such orders from a large number of the best houses in the country.

The Cincinnati Milling Machine Co., Cincinnati, O., are enjoying a large trade, and are doing considerable business in Europe. On the first of this month they shipped four of their universal cutter and reamer grinders to England, two to Germany, and one to Russia. They have over fifty of these machines scattered throughout Europe.

Sewell's Falls on the Merrimack River are to be utilized for the development of electrical power. These falls are about four miles from Concord, Mass., and the current will be utilized for power and lighting purposes in that city. From it 5,000 lights will probably be operated in the city. The central station, which will be built at the falls, will have on the whole a capacity of about 1,200 horse-power.

The stockholders of the Granite Mills, Fall River, Mass., have voted to authorize the directors to erect mill 3, and a proposition was made to increase the capital stock to $800,000, and the number of shares to 8,000. A stock dividend of $100 a share was declared out of the surplus, which amounted to about $763,000. A further increase of the capital stock was made to $1,000,000, $200,000 to be paid in. It will be erected on the old foundation.

The Penn Mills Cotton Manufacturing Company, who for forty years have had their establishment at Allegheny, Pa., are now moving to a suburb of Chicago, Ill. They employ about 400 men, and turn out sheetings and other cotton fabrics on a large scale. About 100 car-loads of their machinery have already been shipped to the new plant. This is the first cotton factory to be established in Chicago, and will perhaps induce others to do likewise.

The machine shop now being erected by McArdle & Sinclair, on Louisiana avenue and Howard street, New Orleans, La., will soon be completed. The lot, 150x320, is located on the line of the Illinois Central Belt Line. The main building is 30x100, the boiler room and blacksmith shop being detached. It is the intention of the firm to erect a foundry in the near future. Employment will be given to about thirty hands at first, and this number will be added to as the work increases.

The addition to the Washburn Machine Shop at the Polytechnic Institute, Worcester, Mass., is nearly completed. The first floor is to be devoted to the elevator plant acquired by the purchase of the Worcester elevator stock. The second floor will be used for putting together elevator cars. The upper room in the tower will be used for photographing, and the basement will contain the blacksmith shop. Two 60-foot passenger elevators are being made for Hollander, Bradshaw & Folsom, of Boston.

The Oriel Glass Company succeeds the Universal Glass Bending Company, which was incorporated under the laws of the State of Missouri, with a capital stock of $20,000. New kilns are now being built by the company at their plant on Twenty-second and Papin streets, St. Louis, Mo. These ovens will be the most complete ever erected for bending purposes. The company will have their entire plant

in operation about the close of the year, and will have better facilities than ever before for handling their growing business.

There is water-works agitation in Berlin, Wis.; San Luis Obispo, Cal.; New Britain, Conn.; Sumner, Wash.; Cannonsburg, Pa.; Charlestown, Mass.; Lowell, Mass.; Duluth, Minn.; Southampton, L. I.; Wilmington, Del.; Terre Haute, Ind.; Newark, N. J.; Lawrenceburg, Ky.; Cassadaga, N. Y.; McKeesport, Pa.; Spokane, Wash.; Yreka, Cal.; Somerset, Pa.; Tazewell, Tenn.; Lafayette, La; Anderson, Ky.; Rochester, N. Y.; Topton, Pa.; Gloucester, Mass.; Hazardville, Conn.; Dothan, Ala.; Ithaca, Mich.; Weston Springs, Ill.; Auburn, Me.

The new plush-mill is now nearing completion at South Portland, Maine. The entire plant, machinery and all, has cost rising $60,000. This does not include the 80,000 feet of land and the wharf, which Mr. Isaac C. Atkinson donated in order to secure this new industry. When the mill starts it will probably go to making car-seat plush and tapestries first. It will have a capacity of about 100,000 yards a year. The officers of the company are ex-Governor Robie, who is president; Mr. C. A. Tilton, who is clerk and treasurer; Mr. Walter Ackroyd, who is general manager, and Messrs. J. J. Gerrish, I. C. Atkinson and P. M. Thurlow, who, with the president, are directors. The new mill will employ from 80 to 100 hands, and its managers hope to have it running by the commencement of the new year.

F. E. Reed & Co., Worcester, Mass., write us: "We have just shipped a car-load of our lathes for use in the Stout Manual Training School, Menomonie, Wis., of which Prof. J. H. Mason is principal in the mechanical department. This is the seventy second educational institution now using machine tools manufactured by us. Prof. Mason, who was delegated by the Manual Training School authorities to select and purchase all the required machinery for the school, is a graduate of class '82, Worcester Polytechnic Institute, and has secured his present desirable appointment for reasons of particular fitness for the place—education, ability and reliability. The Stout Manual Training School is being operated in connection with the public schools of Menomonie. Mr. J. H. Stout, a wealthy and philanthropic citizen of Menomonie, erected the building and presented it to the town. It is brand new, and is considered one of the finest-built and furnished manual training schools in the country."

Messrs. Wendler & Spiro, engineers and architects, of Watertown, N. Y., have, together with Mr. Munro, formerly superintendent of Ryther & Pringle's Works, at Carthage, N. Y., formed a co-partnership under the firm name of Munro, Spiro & Wendler, and have purchased the buildings formerly occupied by the Empire Steam Pump Co., at Carthage, N.Y., and a large tract of land adjoining. The new firm have let the contract for a brick foundry 50x100, with cupola annex 30x25, Collian cupola and traveling crane, and have commenced the work of enlarging the machine shop. They will put in a 10-foot Niles boring and turning-mill; a 72x72"x14-foot planer, having two heads on cross-beam and extra head on upright; a 48x48"x14-foot planer; a 25"x28-foot lathe; full outfit of pattern-making machinery; buzz planer; band saw; speed lathe; upright drilling machine, etc. The shop when purchased had a good plant of first-class tools, and the new ones are to supplement these, so as to enable the firm to build large and heavy machinery. They organized primarily to build the machinery needed by Wendler & Spiro in their business of building and equipping sulphite pulp and paper-mills, and building and equipping talc-mills. The office of the new firm, viz., Munro, Spiro & Wendler, is located in Watertown, N. Y.

Machinists' Supplies and Iron.

NEW YORK, December 3, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15 to $15.50; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $15 to $15.50 for No. 1 Foundry; $13.50 to $14 for No. 2; and $12.25 to $13 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20 for Eglington.

Antimony—The market is barely steady. We quote L. X., 11¼c. to 11¼c.; Cookson's, 11½c. to 11¾c.; Hallett's, 10⅝c. to 10¾c.

Copper—The market is easier; although some business in Lake Copper has been transacted at 12⅜c., it is claimed that 12.10c. would buy at present. The demand is light. Casting Copper is held at 11¼c. to 11¾c.

Lead—Several lots aggregating 150 tons have been sold at 3.75c. The best price bid is 3.70c., while 3.75c. to 3.80c. is asked.

Lard Oil—Prime City is quoted at 85c. to 87c.; Western on spot at 83c. to 85c.

Spelter—The local market continues nominal at 4.40c. to 4.45c.

Tin—Operations are confined mainly to future delivery. The ruling prices range from 20.10c. to 20.20c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—6 machinists. Toledo, Ann Arbor & North Michigan Ry, Owosso, Mich.

Mechanical draftsman, graduate, wants position. C. N., AMERICAN MACHINIST.

Machinist wants job in shop; young man, steady habits. C. S. J., AMERICAN MACHINIST.

First-class tool maker wants situation in New York or vicinity. Box 48, AMERICAN MACHINIST.

Wanted—Machine blacksmith, and two 1st-class machinists on job work. Box 50, AM. MACHINIST.

One first-class man to take entire charge of planer work; two first-class lathe men. Gisholt Machine Co., Madison, Wis.

Wanted—Skillful machinist to take position of foreman in medium-sized machine shop. Apply or address for the pos. at 186 Liberty St., Room 320.

Wanted—Position as sup't or foreman; successful in the systematic mfg. of machine tools, automatic & interchg'ble mach'y. H., Box 310, Florence, Mass.

Position as foreman, by one holding such a position at present, but desires to make a change. Address Box 52, AMERICAN MACHINIST.

Foreman for small shop manufacturing heavy specialties; state qualifications, exp., wages, & give refs. The Decatur Leader Mfg. Co., Decatur, Ill.

Wanted—Position by 1st-class machinist; 25 years experience; 15 years running planers on light and heavy work; had charge also. Planer, AM. MACH.

First-class draftsman, graduated, and with practical exp. in steam and general mach'y, wants to change pos.; charge pret'd. Box 58, AM. MACH.

Wanted—Situation by A1 pattern maker, 18 years' experience on large variety of work; western town preferred. Address J. F. P., AM. MACHINIST.

Position as superintendent, by one who at present is employed as foreman in one of the first-class shops in the country. Address Box 53, AM. MACH.

Wanted—Position by mechanical draftsman of 5 years experience in shop and drafting room; good references. Box 59, AMERICAN MACHINIST.

First-class blacksmith and hammersman desires situation as foreman; experienced in designing dies for drops and steam hammers; strictly temperate. T. B., 10 Madison Terrace, Paterson, N. J.

Mechanical engineer experienced in designing, steam engineering, shop managem't and as factory M. M. wants position; traveling preferred, or would rep. concern at Exposition. S., AM. MACHINIST.

Wanted—Position as machinist foreman or better by practical and energetic man; much experience in handling men and acquainted with a variety of work. Jan. 1st. X., AMERICAN MACHINIST.

Wanted—Young man with some knowledge of mechanical drawing as assistant draftsman; would prefer undergraduate, or graduate of technical school. Address Box 54, AMERICAN MACHINIST.

Wanted—A first-class draftsman competent to take entire charge of our drawing-room. Address, stating experience, and salary required, Sioux City Engine Works, Sioux City, Iowa.

Wanted—Position as designer and draftsman, by graduate of one of lead'g engineer'g colleges; exp. in eng. design'g and testing, mach. tools, structural work and crane work of all kinds, electric, steam, hydraulic & power; also shop exp. Box 55, AM. MACH.

Wanted—A superintendent capable of taking charge of an iron foundry melting betw. 20 and 30 tons of gray iron per day. Apply in writing, giving age, exp., refs., salary expected, to Mechanical Sup't of Thomson-Houston Electric Co., Lynn Mass.

Wanted—Die makers on tinware and sheet metal dies; also A1 man to take charge of die department; permanent situation to first-class men; none others need apply; state experience, and wages expected. Address The Toledo Machine & Tool Co., Toledo, O.

Wanted—A foreman pattern maker; must be thor. fam. with the construction of large and small wood and metal patterns; also to take charge of between 20 and 30 men. Apply in writing, giving age, exp., references, salary expected, to Mechanical Sup't of Thomson-Houston Electric Co., Lynn, Mass.

A competent planer hand wanted; one that is accustomed to doing light, close, accurate work; must be of good habits, and reliable; to the right person will be offered a steady position; state age, wages, and experience. Address R. M. Co., AMERICAN MACHINIST.

Wanted—Foundry foreman capable of taking charge of a foundry making heavy machinery castings & rolls; must be a sober, intelligent & energetic man and a good handler of men; give references and state what salary would be expected; an American under 45 years of age preferred. Address Foundry, Box 57, care AMERICAN MACHINIST.

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Meet all requirements more fully and satisfactorily than any other of its competitors.

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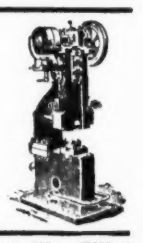

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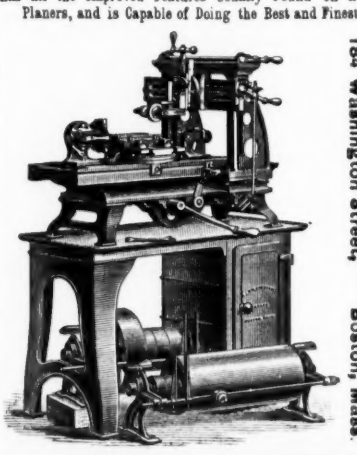
Has all the Improved Features Usually Found on High Grade Planers, and is Capable of Doing the Best and Finest Work.



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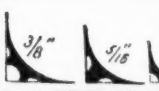

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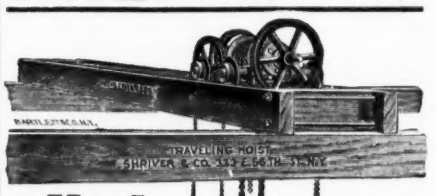

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Timber, Bolts, Track Iron for overhead frame, 11.50.

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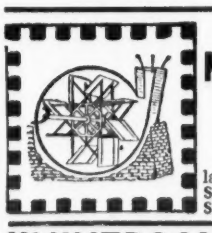

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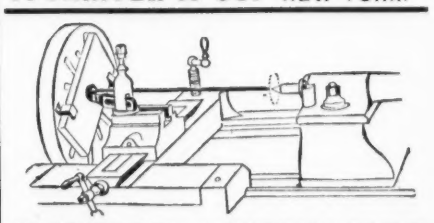

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From ⅛ oz. to 1000 lbs. Small Castings a Specialty. Light machinery wanted to build.

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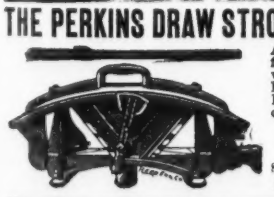

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Maker of all kinds of MACHINERY.

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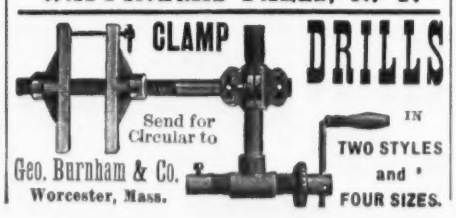

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ALL SIZES AND STYLES, NEW AND SECOND-HAND.

Each machine inspected, and guaranteed to be in perfect working order, before shipment.

RANGING IN PRICE FROM $10.00 UPWARDS.

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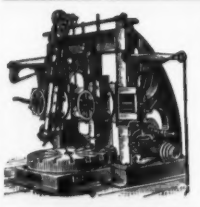

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ASBESTOS SECTIONAL PIPE COVERINGS.

Non-Conducting Coverings for Steam and Hot Water Pipes, Boilers, etc.

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✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—An active, ambitious young machinist who is ready to go onto a printing press erecting floor and learn the business with a view to taking charge of the work. Address, giving age and references, New York, care AMERICAN MACHINIST.

Wanted—Machine shop foreman, by a firm manufacturing heavy machinery; must be of sober, industrious habits and good mech'l abilities, capable of handling men to the best advantage and producing first-class work at minimum of cost; an American under 45 years of age preferred; give references and state what salary would be expected. Address Machinery, care AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d-hd lathes & planers. S.M.York,Clev'd,O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Gang & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Screw-cutting lathes, 18", 21," 23" and 26" swing, offered at very low prices. Box 229, AM. MACH.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy Street, Providence, R.I.

For sale—Machine shop and supply store, doing an increasing business in a growing city. Address Box 49, AMERICAN MACHINIST.

For Sale—Corliss steam eng. 100 H. P., with boilers, shafting, etc.; a bargain for some one. Address Orrin E. Jones, 416 High St., Providence, R. I.

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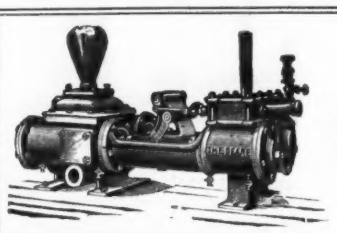

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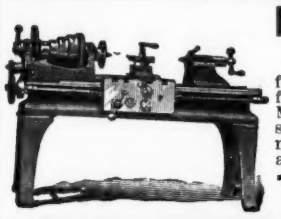

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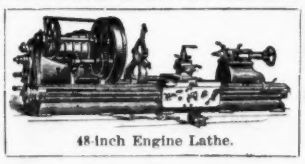
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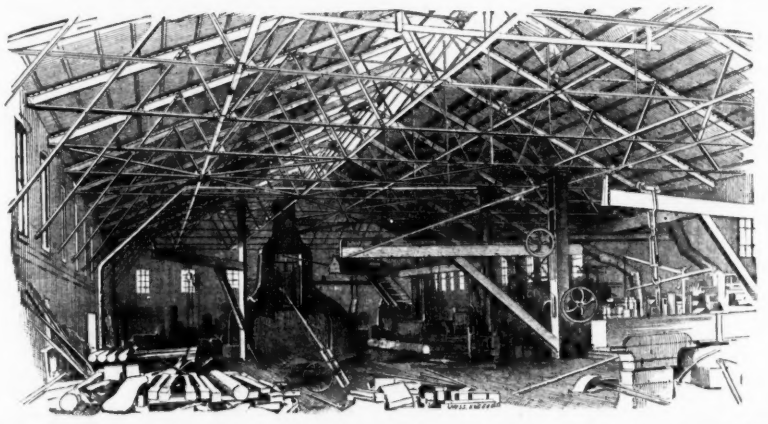

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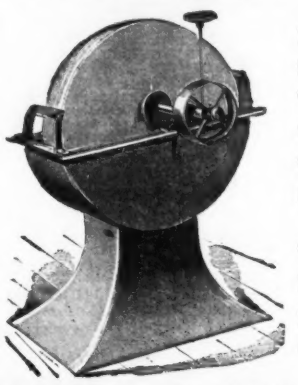

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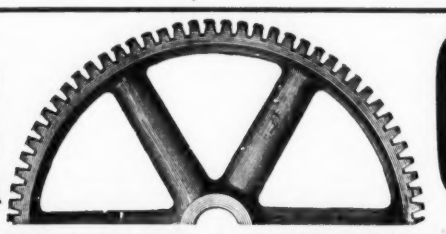

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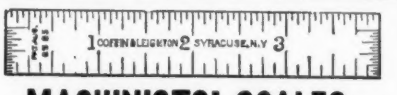

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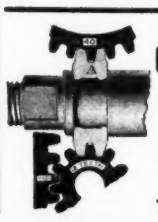

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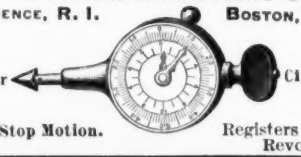

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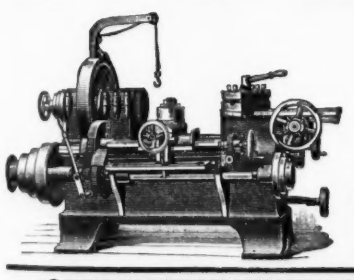

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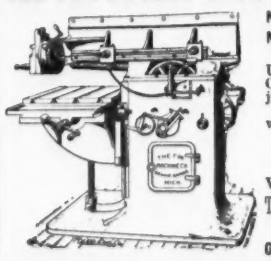

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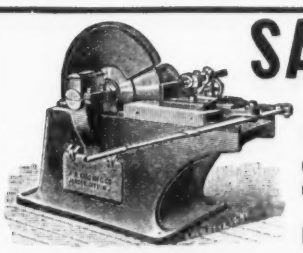

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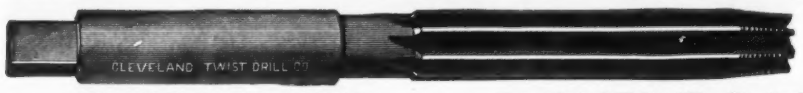

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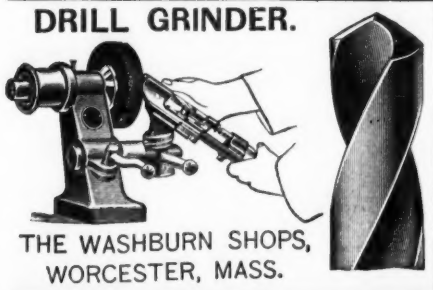

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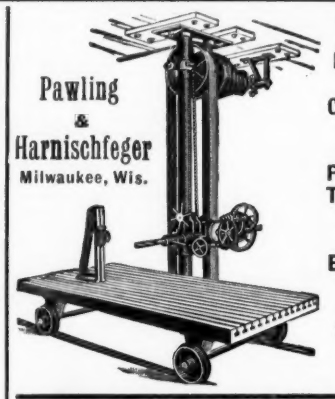

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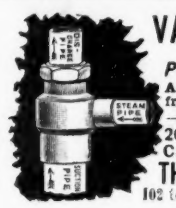

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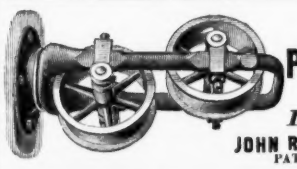

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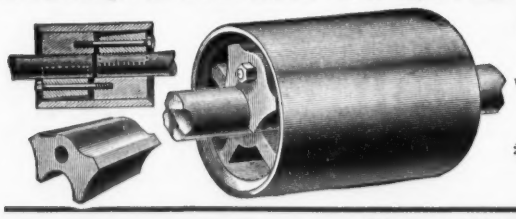

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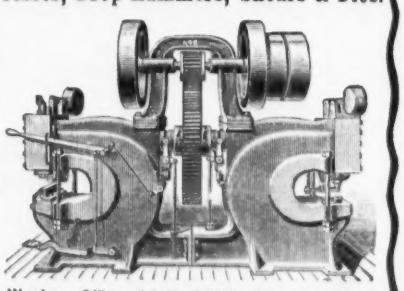

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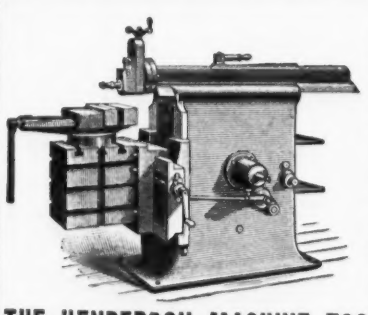

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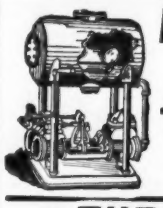

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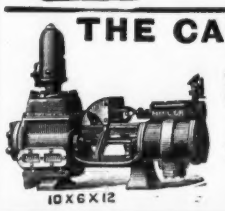

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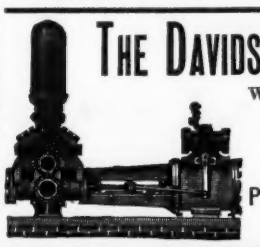

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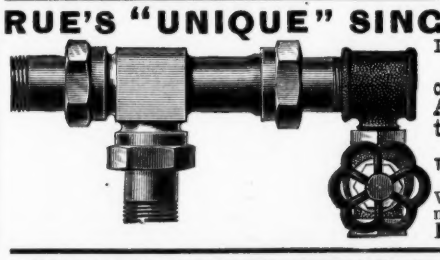

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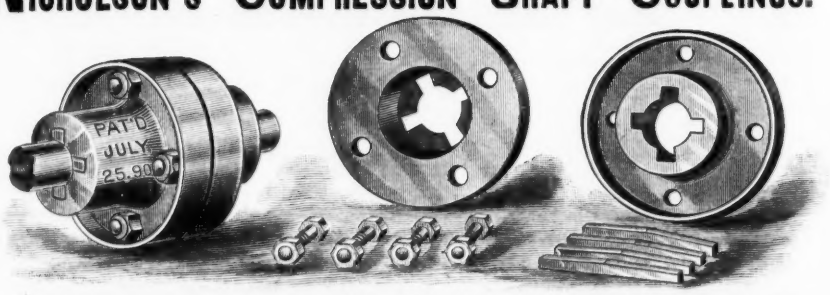

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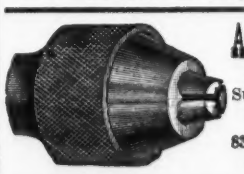

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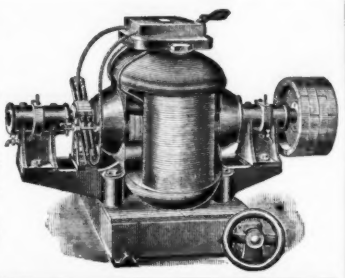

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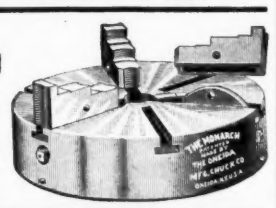

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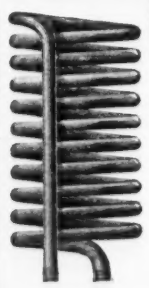
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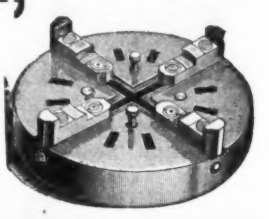

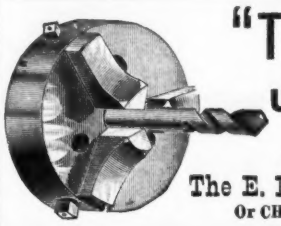
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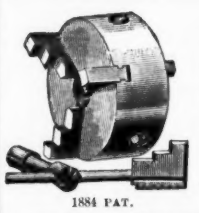
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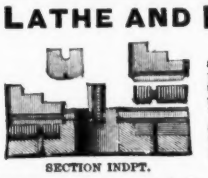
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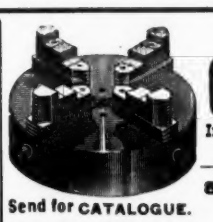
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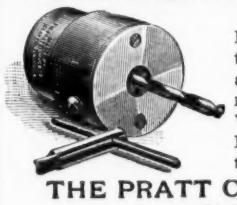
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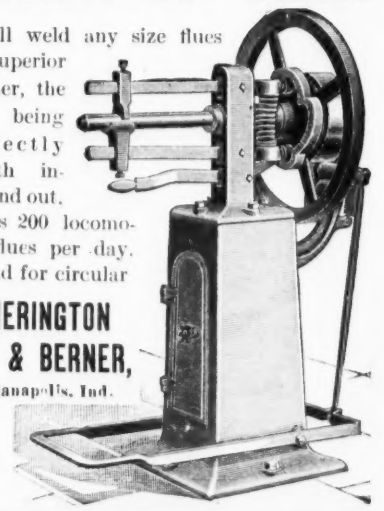
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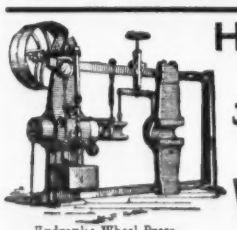
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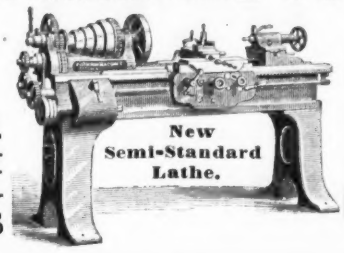

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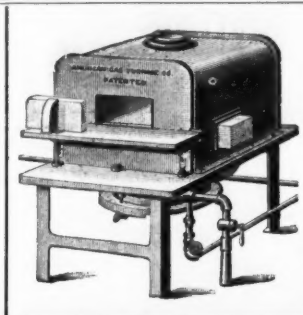

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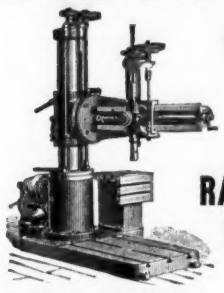

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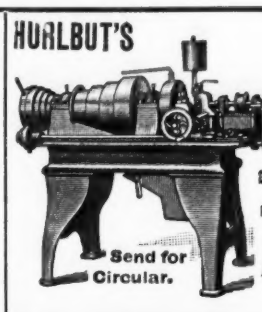

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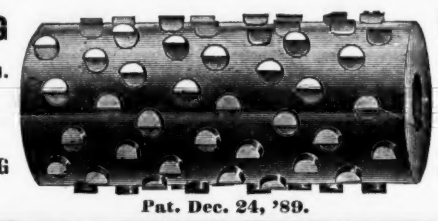

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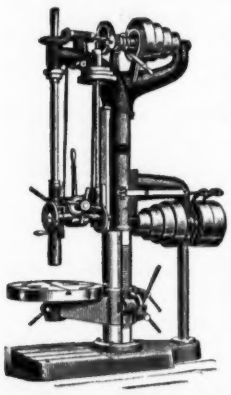

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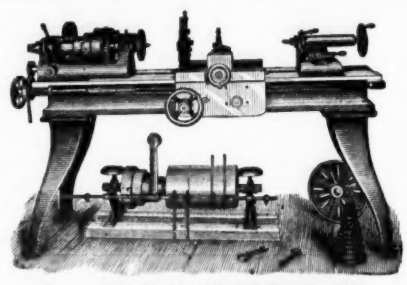

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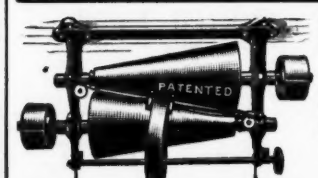

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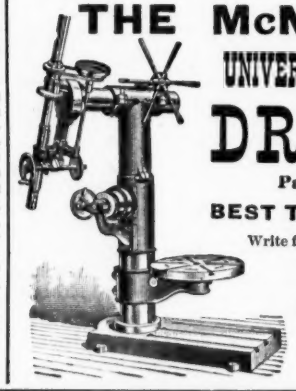

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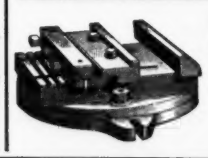

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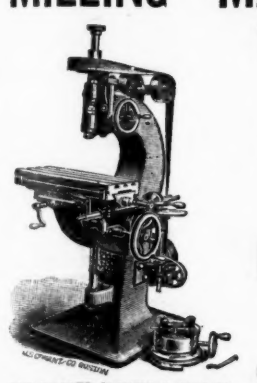

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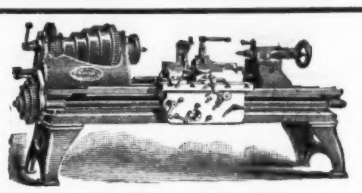

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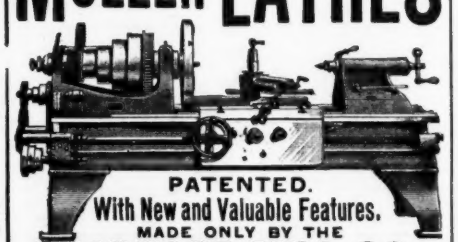

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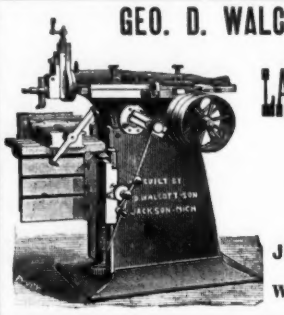

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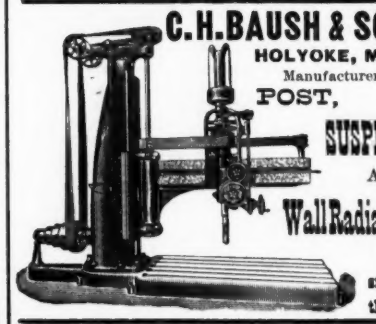

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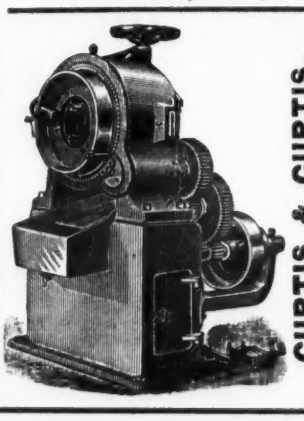

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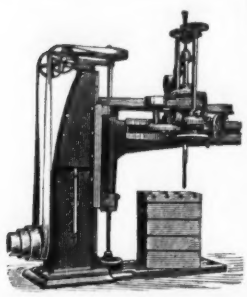

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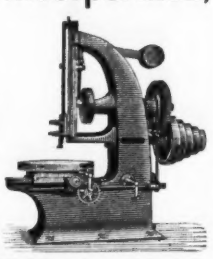

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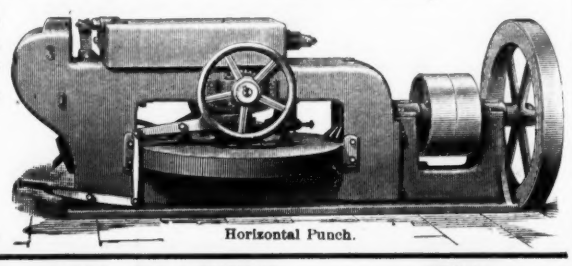

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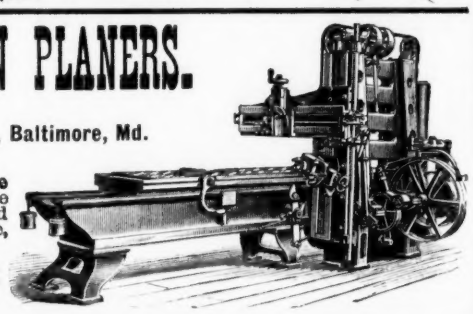

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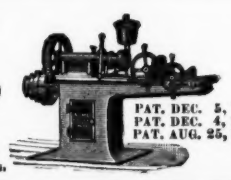

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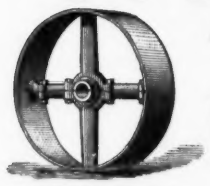

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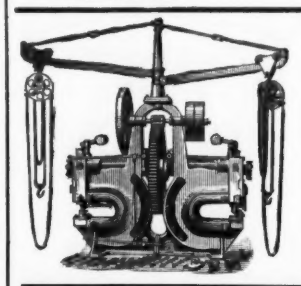

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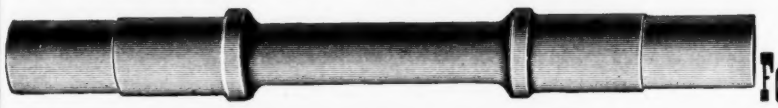

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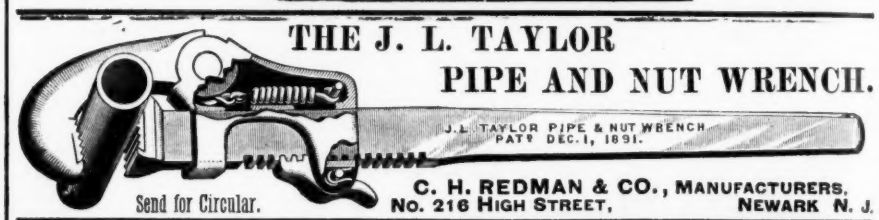

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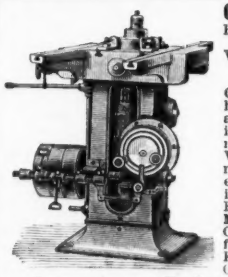

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With recent patented improvements we guarantee to do the following class of work.

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Will cut through 4-foot hub, through 5-inch hole. Our new centering chuck and setting attachment the work can be set exactly, without the use of a scale or rule. Our new binding attachment saves three-fourths of the time used on any other machine for binding work on. Our machine will cut a key-way and make a key to fit it.

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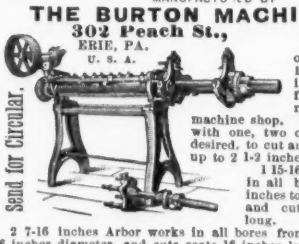

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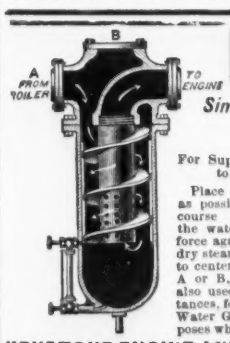

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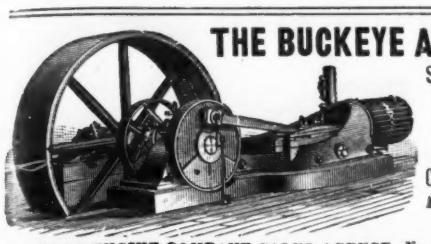

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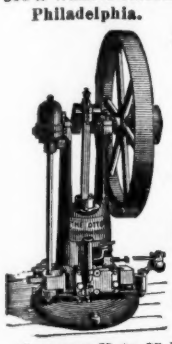

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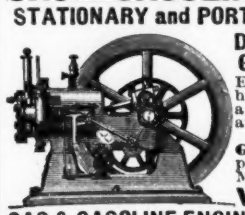

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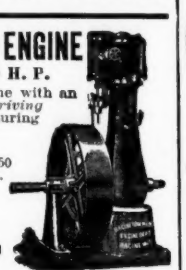

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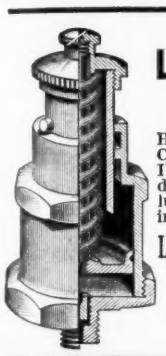

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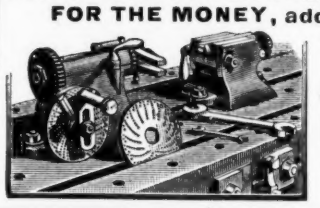

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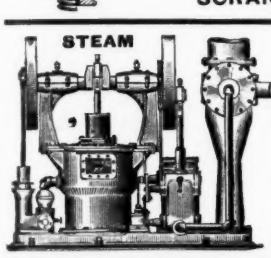

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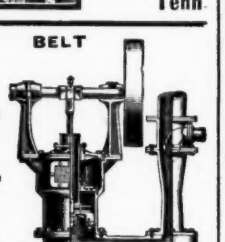

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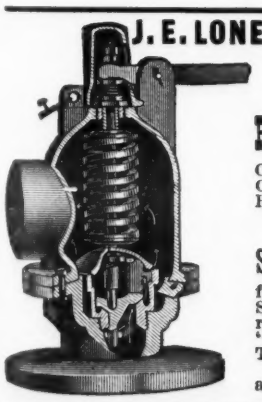

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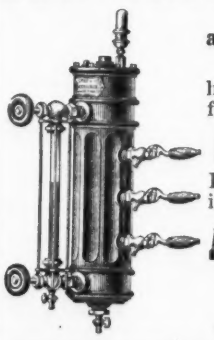

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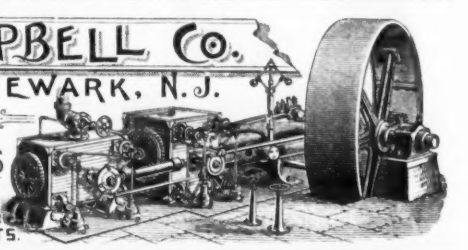

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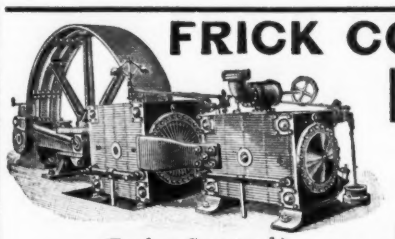

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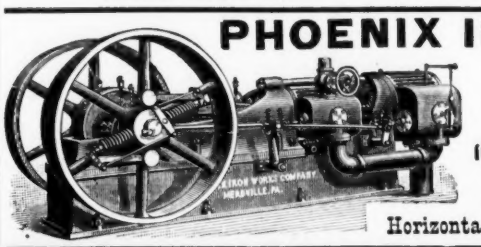

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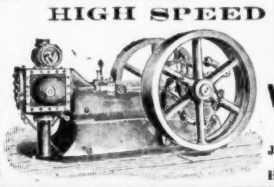

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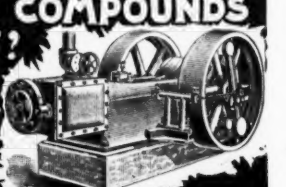

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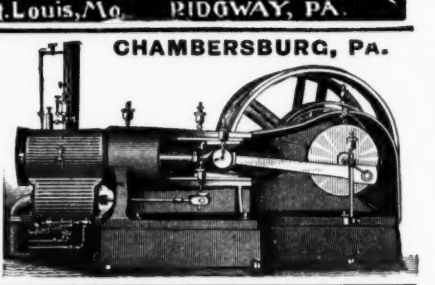

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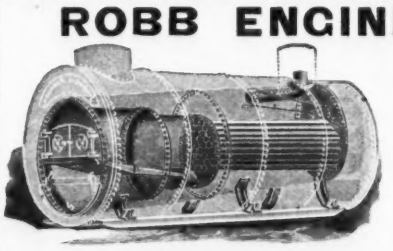

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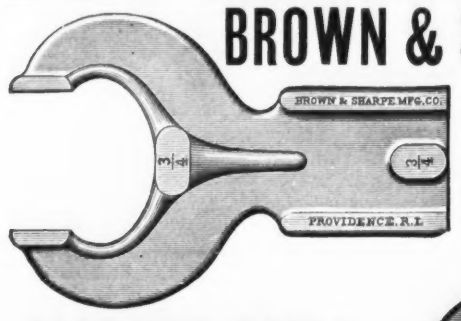

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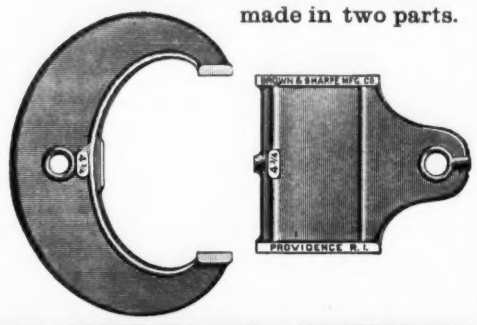

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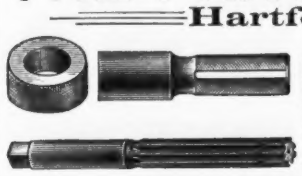

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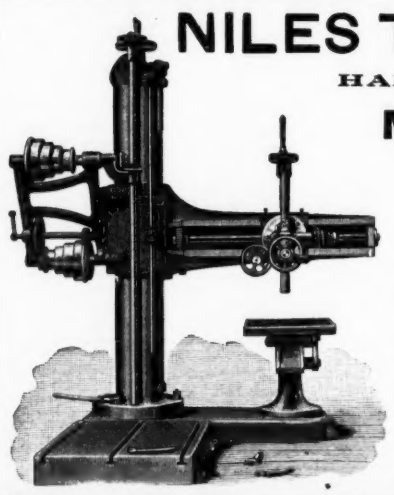

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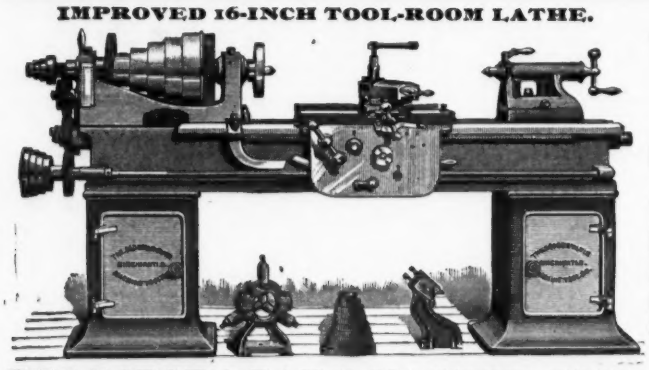

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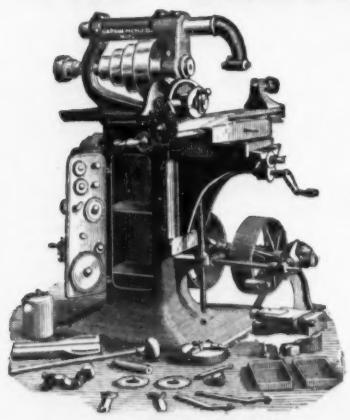

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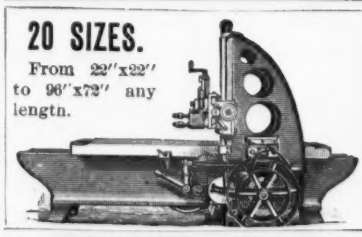

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